The Electrical Industry's Weekly Magazine

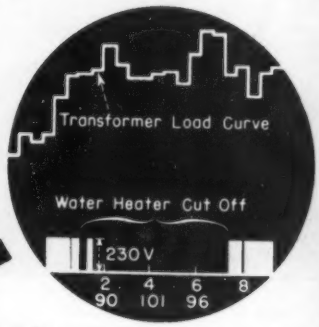
April 1, 1957

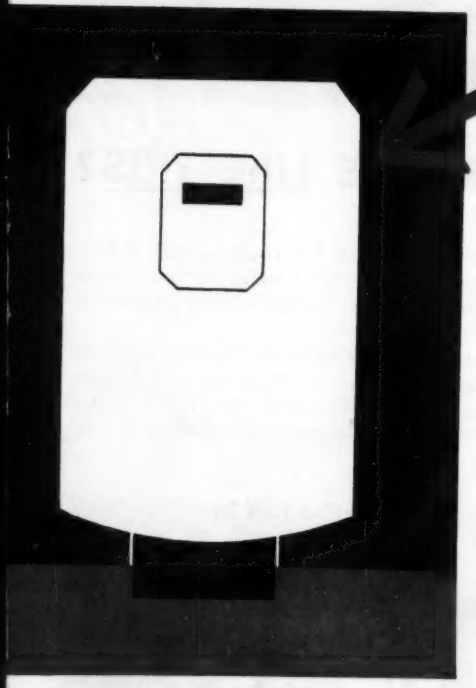
Electrical World

Price 50 Cents

A McGraw-Hill Publication

Transformer Load Cuts Water Heater Service...





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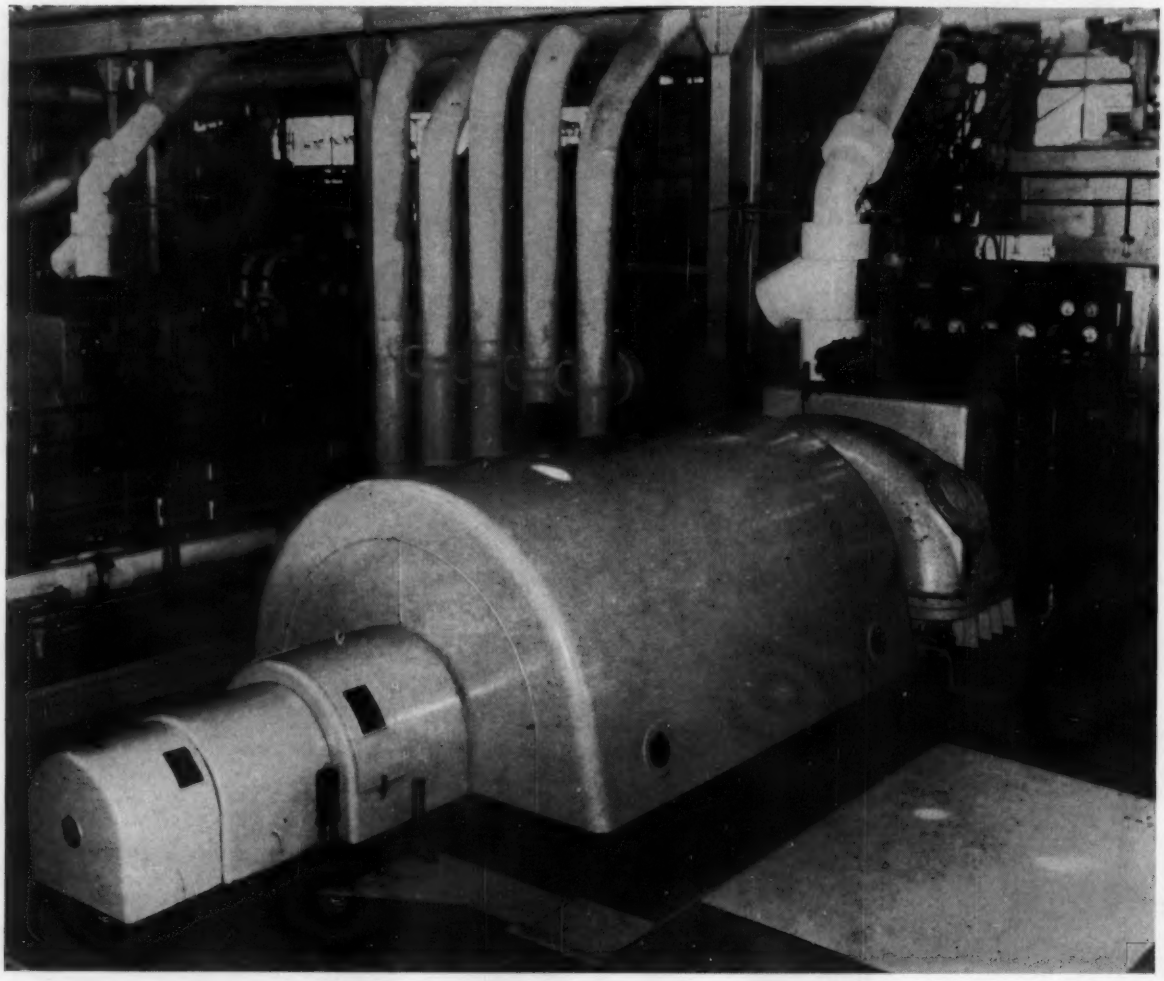

WOULD YOU LIKE TURBINE PERFORMANCE LIKE THIS?

LONG YEARS of trouble-free turbine performance are assured users of *Texaco Regal Oil R&O*.

"It has kept our turbine systems free from sludge, rust and foam," reports one operator who started using this great oil back in the Thirties. And he adds that, "when we installed two new 10,000 kw turbines, *Texaco Regal Oil R&O* was the logical choice for these new units."

The ability of *Texaco Regal Oil R&O* to keep systems clean and clear of rust, sludge and foam, means trouble-free operation—normal bearing temperatures, instant governor response.

There is a complete line of *Texaco Regal Oils R&O*, all of them refined and processed under the most stringent specifications of quality to meet the requirements of all leading turbine builders.

Help in selecting the right lubricants for your turbines and auxiliaries is available to you by calling your Texaco Lubrication Engineer. Simply contact the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States or write:

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The Texas Company, 135 East 42nd Street, New York 17, New York.

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FOR ALL TURBINES

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Electrical World

Vol. 147, No. 13 APRIL 1, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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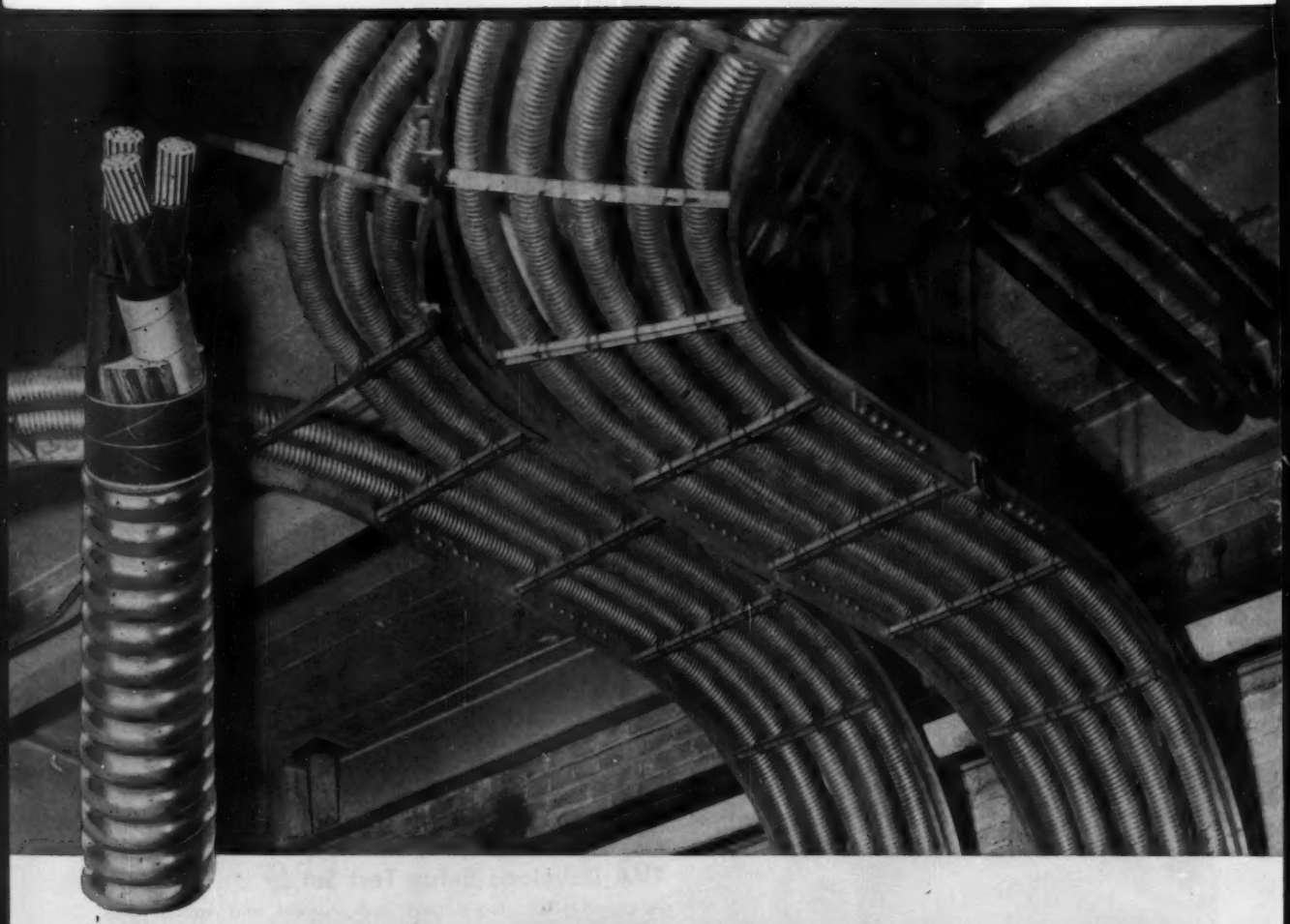

cut cable installation costs the modern way...

with Loxarmor — the modern armored cable whose strength and flexibility make it a cost-saving alternative to conduit-enclosed cable. Rubber-insulated Loxarmor with its interlocking S-shaped armor is ideal for either power or control circuits.

Lower installation costs — Loxarmor eliminates conduit and related installation costs such as making bends and using pull boxes... especially economical to use in cramped quarters.

Easier to add or re-route circuits — Usually trained in trays or racks, Loxarmor cables are easily re-routed and are 100% salvageable. New cables are quickly added to existing trays.

Use indoors or outdoors — Loxarmor can be used in wet or dry locations. Indoors or outdoors, Loxarmor cables are readily accessible for easy inspection and maintenance.

Less space required — Multiple Loxarmor circuits require only a little more than half the space needed for equivalent conduit circuits.

Loxarmor can be supplied over any standard Okonite insulation—rubber, varnished cambric or plastic—depending upon your installation conditions and voltage requirements. It is available with galvanized or stainless steel, aluminum or bronze armor. Either copper or aluminum conductors are of course available.

For dimensional data on Okonex rubber insulation applied by the strip-insulating process write for Bulletin EW-1090. Complete splicing and terminating drawings and instructions for Loxarmor are also included. The Okonite Company, Passaic, N. J.

where there's electrical power... there's **OKONITE CABLE**

4740

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. . . from the publisher

You've probably never thought of Electrical World as exactly being bedside reading material. But it might well become that before long.

Half of our readers now prefer to read their magazine at home instead of in the office. This at least is what a survey made last fall by McGraw-Hill's Research Department showed.

Some copies go there directly via the postman, others from the office via the briefcase. A Chicago commuter turns his travel time into a business briefing session by taking it with him on the train. A young Philadelphia distribution engineer goes through it as he babysits on his wife's weekly PTA nights. In summer a California utility man reads it while he waters his lawn. Explains one home-prone reader: "Reading a business magazine at home is as natural as talking shop at a party."

Sounds like a good idea. For anyone with the old "I-don't-have-time-to-read" complaint, getting Electrical World at home makes sense. Away from clattering typewriters, jangling phones, and all the interruptions, the material becomes just that much easier to absorb. Saves time and makes a more lasting impression, too. These home readers turn an odd moment here and there into a profitable business education experience.

Fischer Black

ELECTRICAL WORLD

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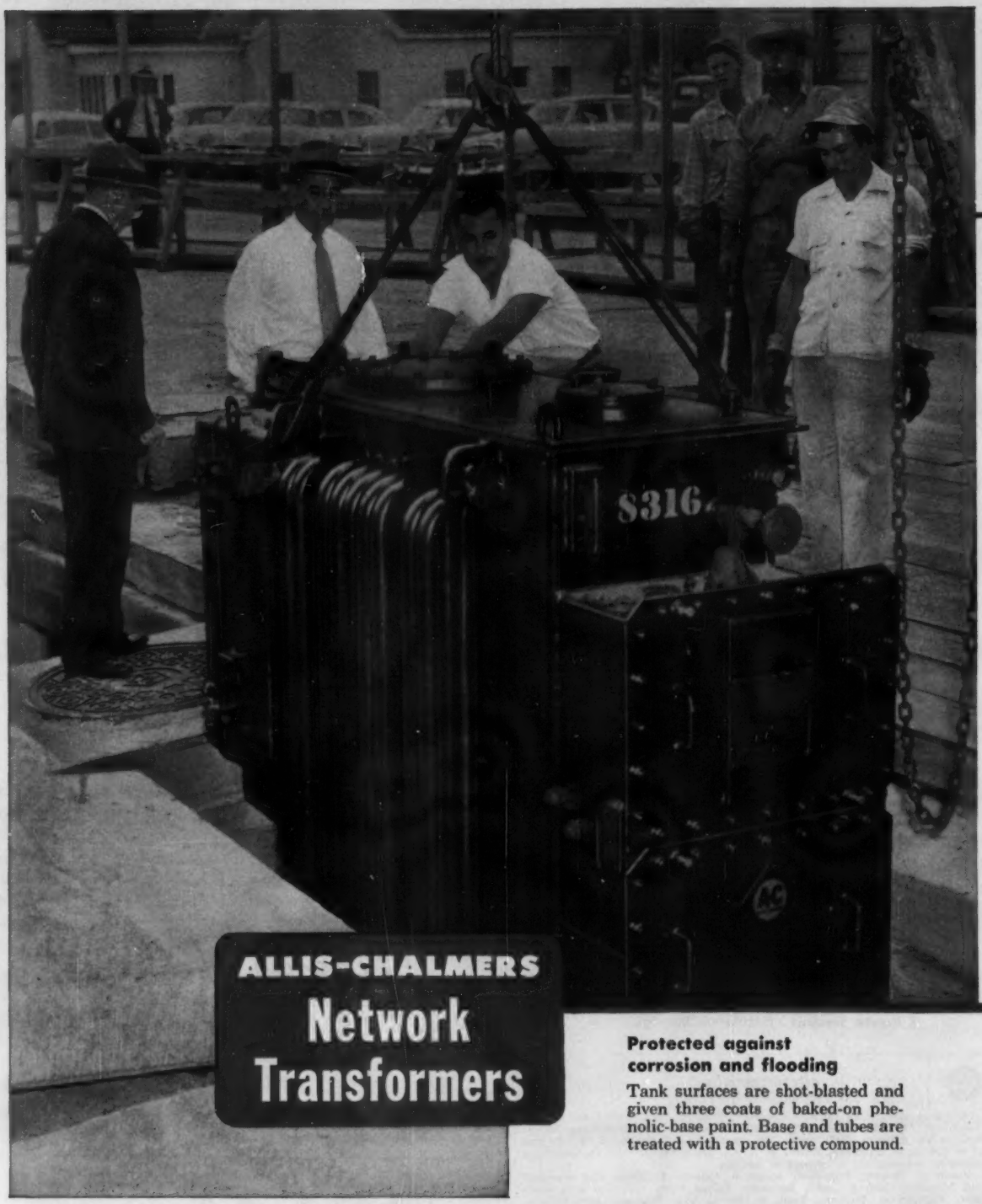
To meet growing



Protected against corrosion and flooding

Tank surfaces are shot-blasted and given three coats of baked-on phenolic-base paint. Base and tubes are treated with a protective compound.

ALLIS-

system needs

. . . in
Corpus Christi,
Texas

Central Power and Light Company Installs Allis-Chalmers network transformers for its own office building

As a utility, Central Power and Light Company has had the opportunity to observe and compare the performance, reliability and maintenance advantages of many makes of transformers. An application of Allis-Chalmers network transformers *at* CP&L's office building is shown here.

If you are planning to modernize or expand your network systems, investigate the many advantages of Allis-Chalmers transformers — advantages that have merited the complete confidence of Central Power and Light Company and utilities everywhere. For all the facts, contact your nearby Allis-Chalmers representative or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Up goes another building in bustling Corpus Christi.

Down into the vaults go Allis-Chalmers network transformers.

High thermal capacities

Liberal ducts throughout both the high voltage and low voltage coils assure ample circulation of cooling liquid.

Special design of bushing seal

Spiral-wound metallic gaskets adjust to changing operating conditions. Can be installed without grease or cement.

Major gaskets eliminated

Main cover and switch compartment are welded to tank. Oil sludging and oxidation of insulation are held to a minimum.

CHALMERS

A-C ALLIS-CHALMERS

A-5198

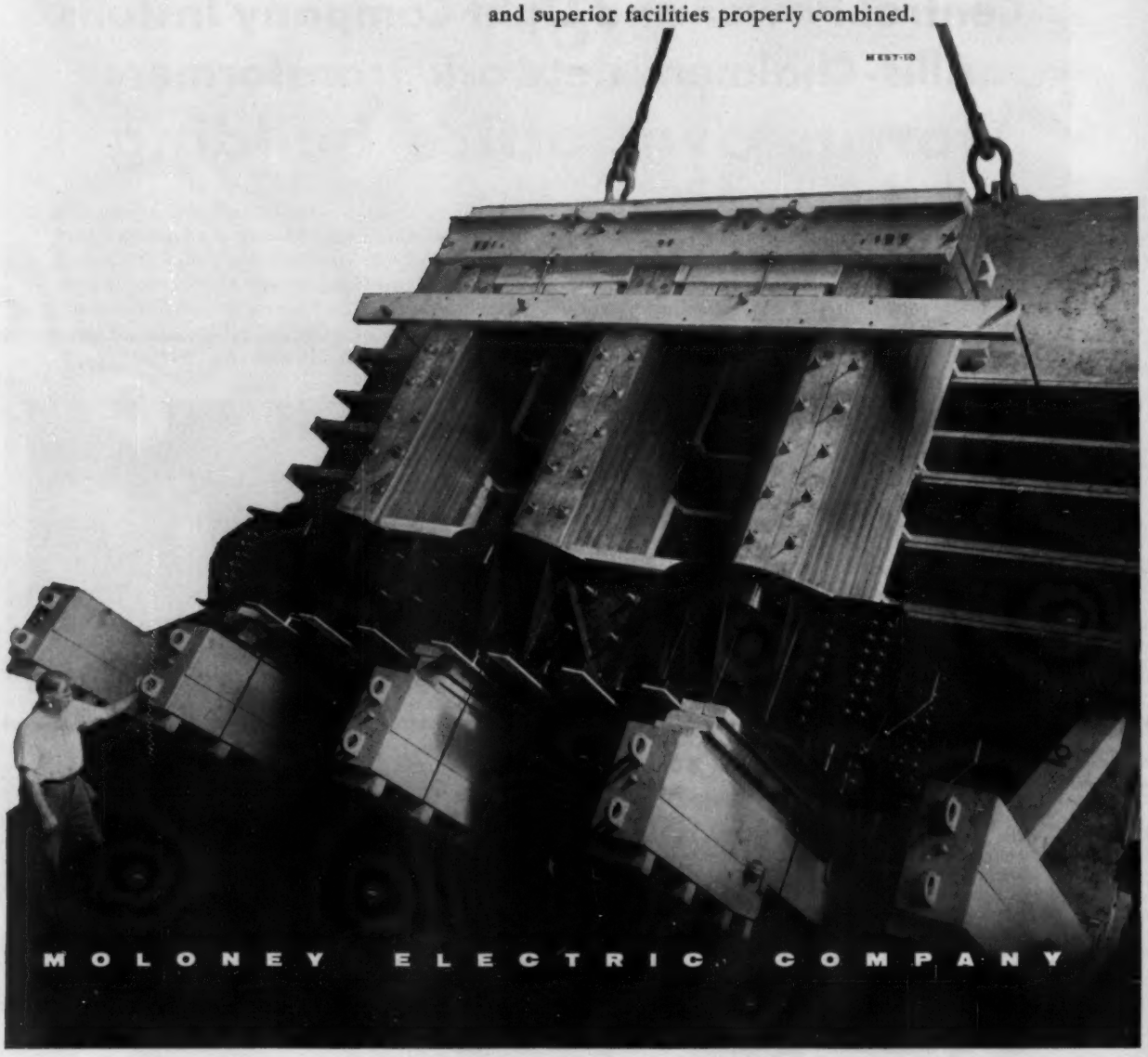
A good old-fashioned way to put a baby to sleep is to rock it!

In like fashion, in putting a transformer to bed, a good way is to test it! Along the way, to complete fabrication and assembly, are many operations. One is "rocking" the core to an upright position for integration with the coils. This unique equipment permits the

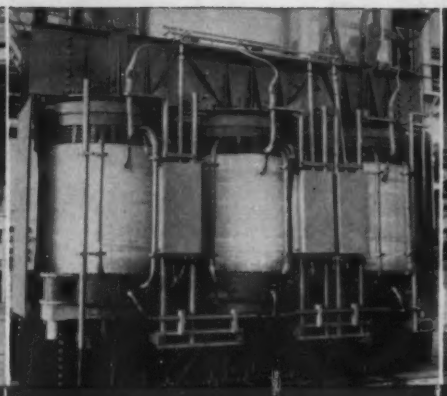
ROCK-A-BYE BABY! . . .

fabricators to stack core laminations in a very precise manner, quickly and easily. The result; less possibility of mechanical fabricating error, and perhaps more important, less interval to delivery of the transformer

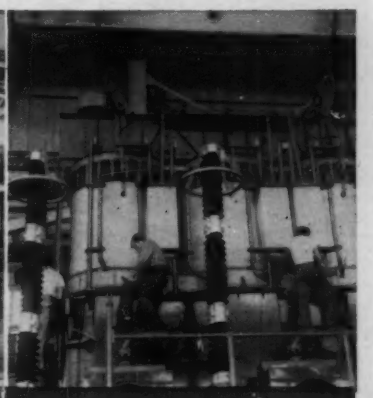
Just another example, of many, of the advantages of know-how and superior facilities properly combined.



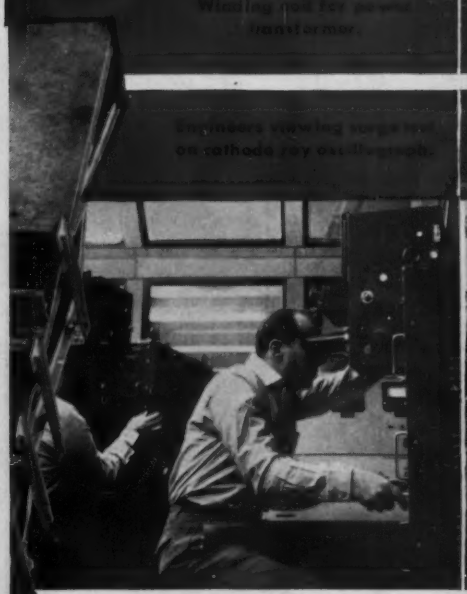
Winding coil for power transformer.



Assembled core-and-coil unit.

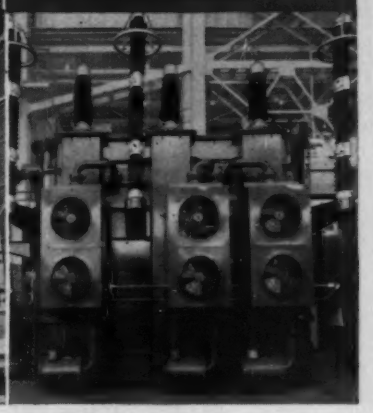


Lowering core-and-coil unit into transformer tank.



Engineers viewing surge test on cathode ray oscillograph.

Transformer undergoing tests in surge generator bay.



Completed transformer rated 12,500 KVA, 3 phase, 60 cycle, F. O. A. Outdoor Type. High voltage 115,000 Y, 66,400 Low voltage 13,800 Delta.

MOLONEY ELECTRIC

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

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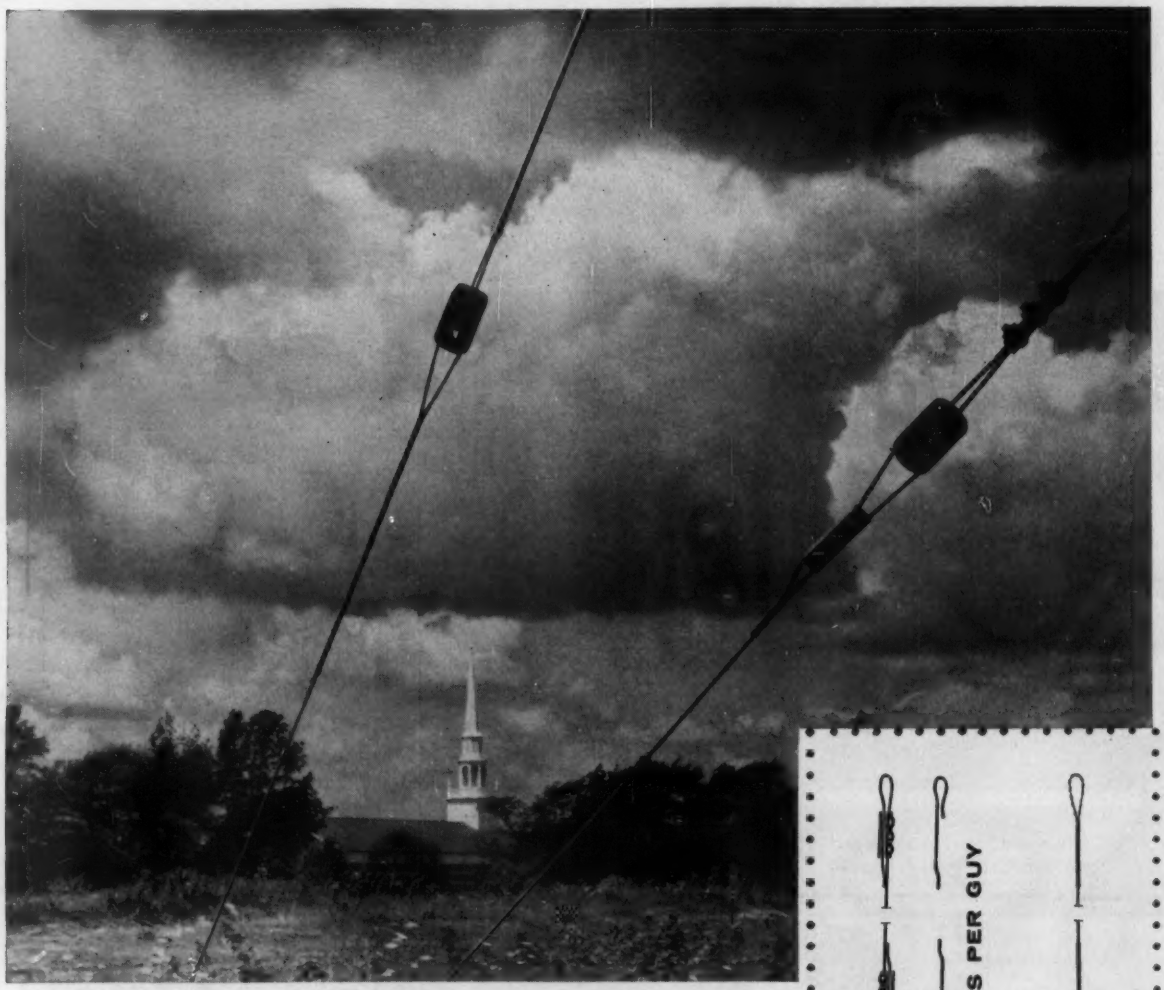
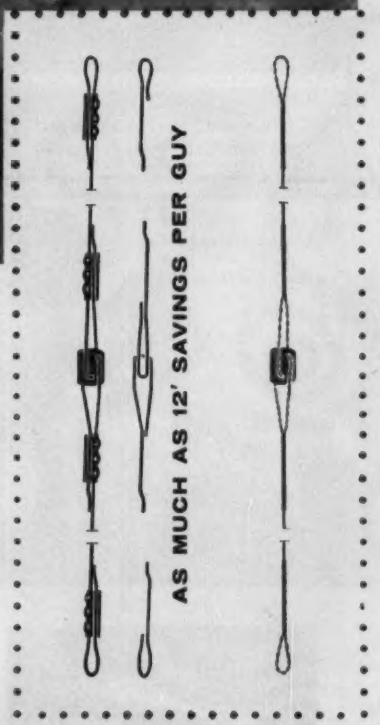
SALES OFFICES IN ALL PRINCIPAL CITIES



Up to 30% savings in strand... with PLP Guy-Grip Dead-Ends

You will find real guying economy with PLP Guy-Grip dead-ends. Because they eliminate strand looping, you can use *shorter, straight* lengths of guy strand. This means as much as 12 feet savings in strand per guy. What's more, the finished installation is neat, streamlined, efficient.



PX-80

Made in accordance with or for use under U. S. Patent No. 2,761,273; other patents issued and pending.

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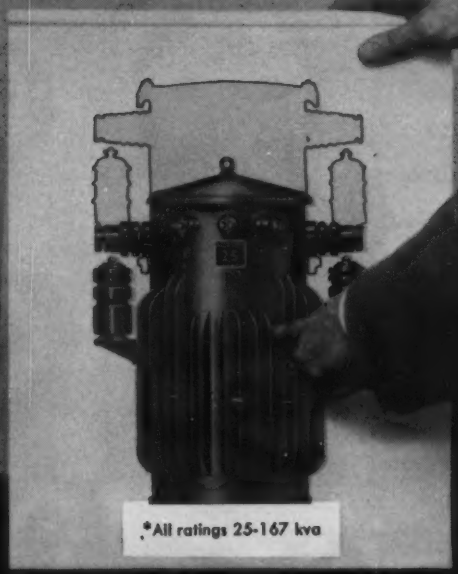
Your Westinghouse representative can prove...

NEW CHANGEOUT SAVINGS

Because all new Westinghouse transformers* are up to 13" shorter, 33% lighter, you can now make changeouts to next higher kva ratings without replacing poles or relocating secondaries

Among major utilities enjoying the advantages of Westinghouse "new-size" full-capacity transformers is Alabama Power Company, whose D. D. Wendel, manager of transmission and distribution, is seen here with John Main, Westinghouse Birmingham representative.

J-70787



*All ratings 25-167 kva

YOU CAN BE SURE...IF IT'S

Westinghouse

This is the main control board and associated instruments in the central control room of Duquesne Light Company's Shippingport (Penna.) Plant, America's first full-scale atomic power plant, to be completed in the fall of 1957. Photo by Robert Yarnall Richie.

In the electric power industry . . .

Is your product in the "big picture"?

Sharply focussed in the Electric Power Industry's big picture for 1957, eyed hungrily by many a manufacturer, is the $4.8 billion the industry has tabbed for expansion spending. Twenty-eight percent more than 1956 and, percentage-wise, double or better the expansion planned by any other industry*, here's where this $4.8 billion will go.

Generation	$2.2 billion
Transmission	.8 billion
Distribution	1.6 billion
Miscellaneous	.2 billion
Total	$4.8 billion

Bold, vigorous, hard-driving, the '57 growth plans of electric utilities present a sales challenge that will be met only by matching sales effort. To the manufacturer with vision and heart to make this effort will go the lion's share of a record-breaking market, a market which will be buying new equipment and materials at the rate of nearly $100,000,000 weekly!

There is no more effective way to impress your product story on this high-spirited, big-spending, spacious market than with regular, low-cost *weekly* sales calls through the pages of

"The Electrical Industry's Weekly Magazine"

**All manufacturing industries combined are increasing '57 expansion spending over '56 by 14%.*

"The Electrical Industry's Weekly Magazine"

Electrical World

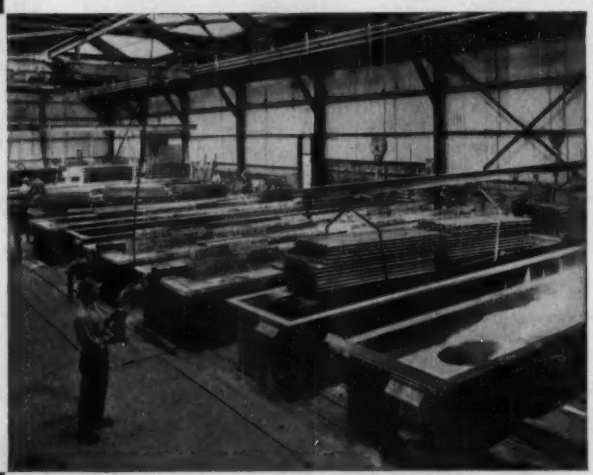
A McGraw-Hill Publication, 330 West 42nd Street, New York 36, New York

When Bethlehem gets the job . . .

SKILLED ENGINEERS plan production of your towers and switchyard structures. Their detail drawings assure accurate, efficient fabricating. They tell our shopmen exactly where to punch and shear . . . to within 1/32 inch! Takes good men and good tools to do this kind of job.

RACK PUNCHES (shown here) as well as tandem and cluster punches are among the *specialized* equipment necessary. Holes must be accurate in position and size—they can't be reamed after galvanizing. There's all the difference in the world between tower work and ordinary structural fabricating.

GALVANIZING protects the steel from corrosion. The pieces are thoroughly cleaned, pickled, immersed in an electrically controlled zinc bath, then quenched. We do our own galvanizing, of course. All three Bethlehem tower shops are equipped with the latest word in galvanizing facilities.



FINISHED STEEL is carefully sorted in the shipping yards. You receive each individual tower "package," including fasteners, ready for speedy erection in the field. Our tower-fabricating works at Leetsdale, Pa. (near Pittsburgh), South San Francisco, Calif., and Seattle, Wash. are strategically located to fill your tower and switchyard requirements. May we quote on your next job? Please contact the Bethlehem sales office nearest you.

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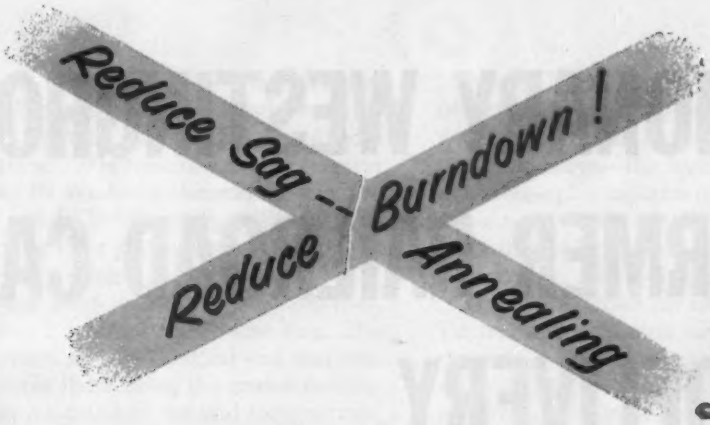


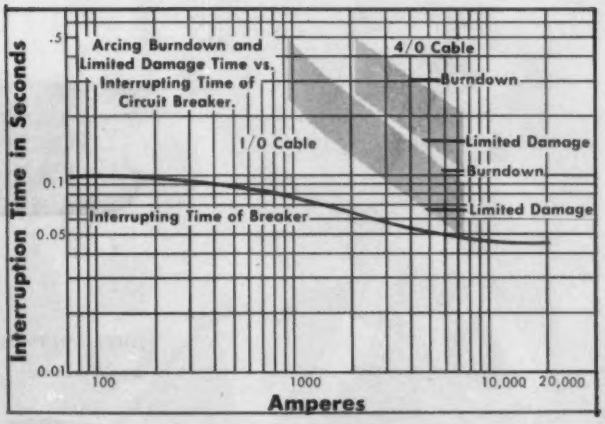
All Allis-Chalmers Air Magnetic Breakers are 5 cycle

NOW — 5 cycle interruption is standard on all Allis-Chalmers air magnetic breakers at no increase in price. Typical interruption curve for a *Ruptair* magnetic breaker is superimposed on a wire burndown characteristics chart shown below to illustrate the coordination that may be obtained with these Allis-Chalmers breakers.

The faster clearing time afforded by these breakers will reduce the effect of a fault on the system — reduce the problem of sagging wires, annealing and burndown.

All Allis-Chalmers switchgear assemblies and primary unit substations are equipped with these 5 cycle *Ruptair* breakers.

For further details contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



A commonly used overhead distribution wire is No. 4 wire. This curve shows no wire damage occurring when coordinated with this 5 cycle breaker. Notice that interrupting time is well under 5 cycles on heavier currents and is fast on low currents, too.

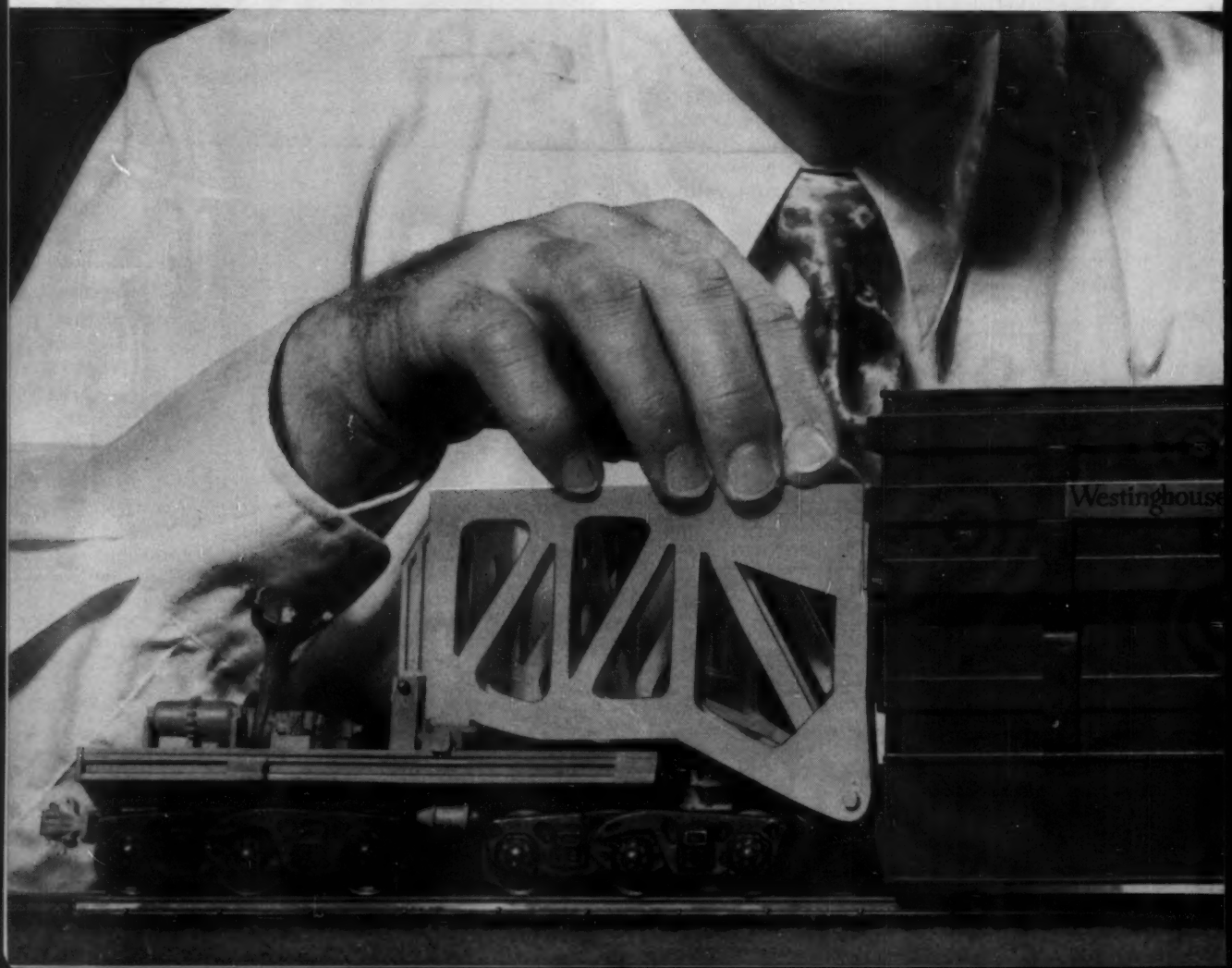
ALLIS-CHALMERS

A-5257

for progress in switchgear

REVOLUTIONARY WESTINGHOUSE TRANSFORMER RAILROAD CAR SPEEDS DELIVERY, SLASHES INSTALLATION COST

Truss-supported transformer travels only six inches above rails—compared with forty-eight inches when loaded on depressed-center car. Lower center of gravity allows faster rail movement; transformers need not be sectionalized . . . saves you installation time and cost.



Westinghouse Form-Fit® power transformers —which for 15 years have led the industry with record-breaking capacities now have even more "room to grow". A revolutionary new railroad car, designed by Westinghouse and built by the Greenville Steel Car Company will make it possible to ship even greater capacities upright without sectionalizing.

The new car has a load capacity of 250 tons, and will carry a transformer 28 feet long. The car is comprised of two identical end sections, the transformer itself being the center section. Steel trusses mounted on the end sections support the transformer. Although the car has a total length of almost 90 feet when carrying the maximum size transformer, it will negotiate the same curves as a standard boxcar. This allows more direct routing . . . time saved helps speed your construction schedules.

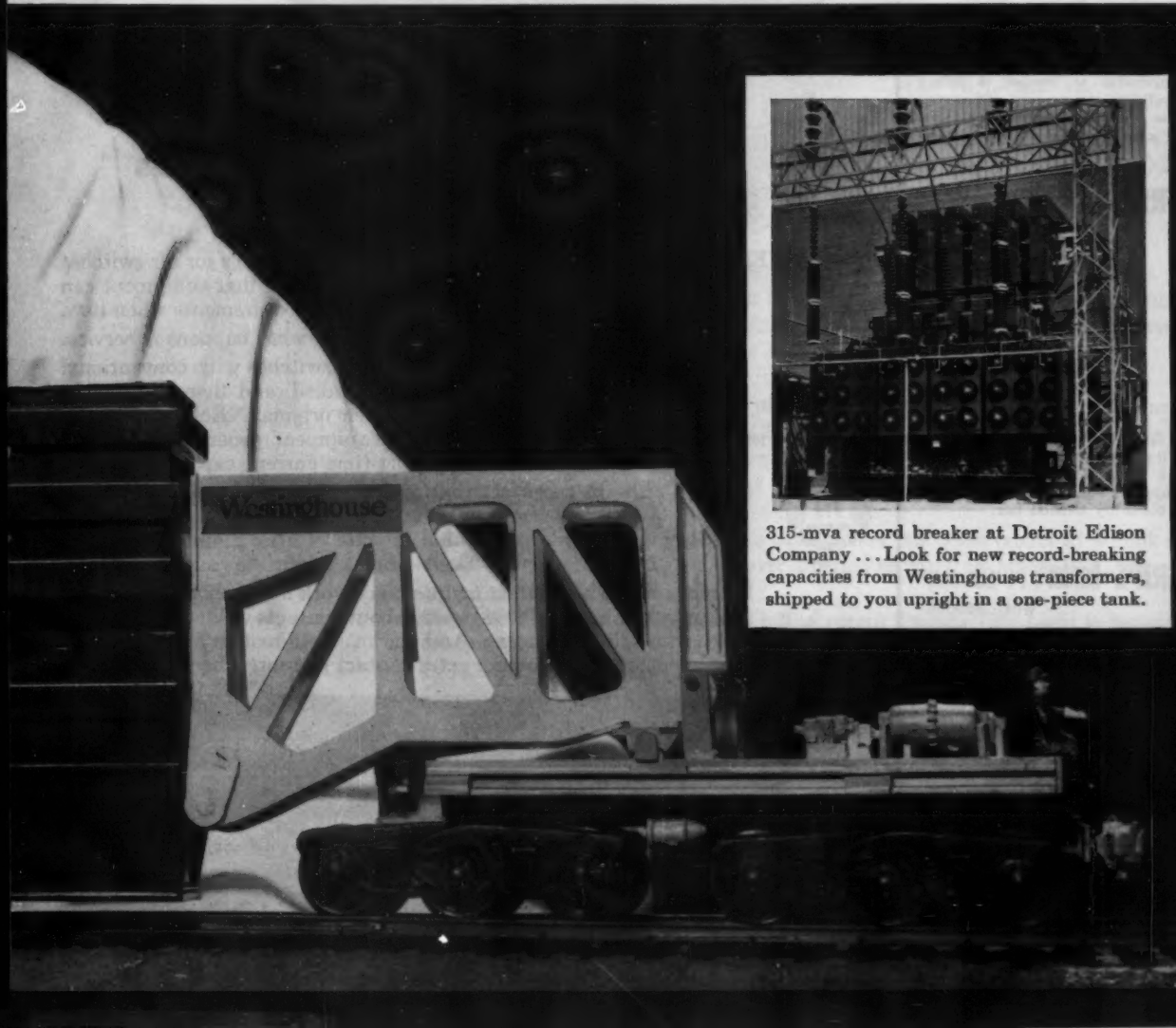
Westinghouse Form-Fit power transformers utilize the basic shell-form transformer design with the coils inside the core. This provides more compact design—the highest rating-per-pound available—plus superior mechanical and dielectric strength and thermal capacity . . . increasingly important factors as transformer ratings and physical size both grow.

The new railroad car for transporting Form-Fit transformers adds new possibilites to this room-to-grow design, provides the means for shipping still larger transformers . . . at the same time cuts your delivery time, installation time and cost.

J-70805

YOU CAN BE SURE...IF IT'S

Westinghouse

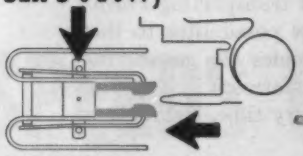


315-mva record breaker at Detroit Edison Company . . . Look for new record-breaking capacities from Westinghouse transformers, shipped to you upright in a one-piece tank.

NEW! Revolutionary S&C Contact Cuts Cost of Switch Maintenance!

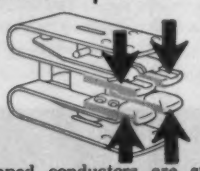
4-Point Advantage

SLIPS e-a-s-i-l-y



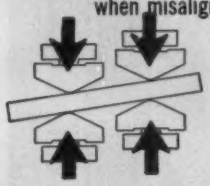
Tension bar and spacer prestresses contacts and reduces necessary force required to close contacts (effort at switch handle). Narrow convex silver-clad contact surfaces plow away any dirt from silver-nickel insert on blade tongue.

GRIPS at 4 points... not 2



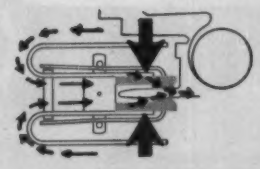
U-shaped conductors are split lengthwise to provide 4 independently sprung contact fingers. The pressure is applied to each by a flat beryllium copper loading spring.

GRIPS at 4 points... even when misaligned



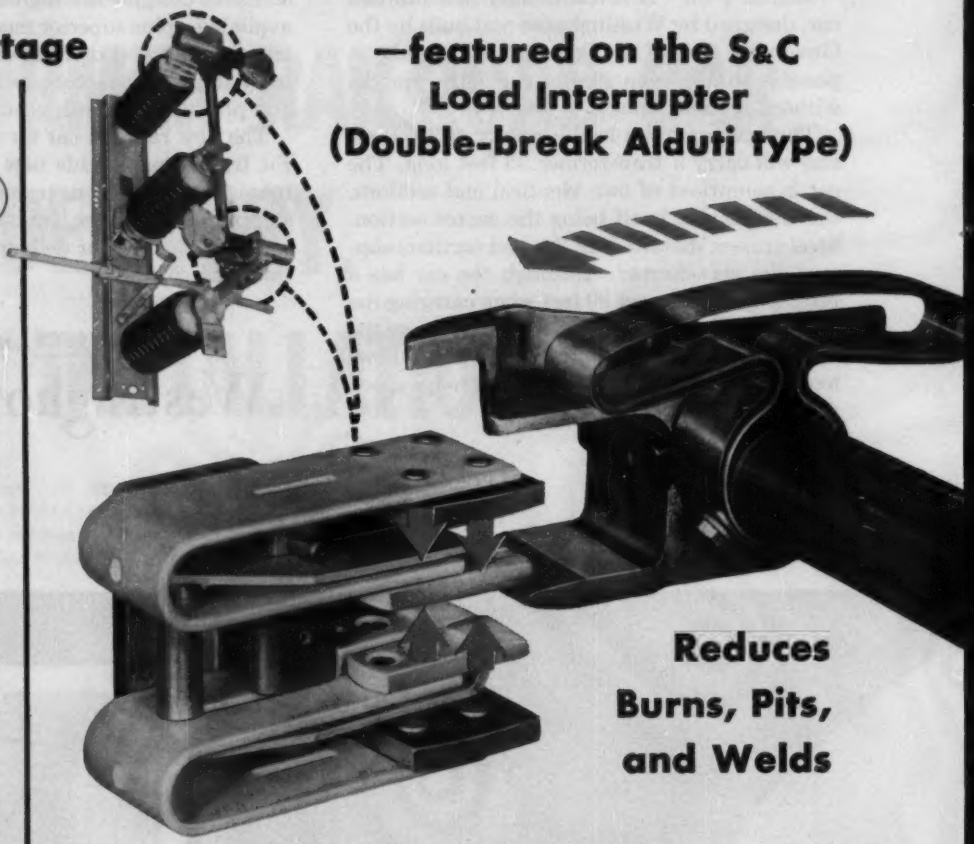
For 2 reasons: (1) Pressure is applied independently by springs in 3-point suspension which can rock and roll; and (2) pressure is applied equally on either side of blade by tension bar.

GRIPS harder... but only when needed



Inner branches of U-shaped conductors are attracted to each other by the heavy magnetic fields of short-circuit currents. Hence, you get heavier contact pressure when you need it.

—featured on the S&C Load Interrupter (Double-break Alduti type)



Reduces Burns, Pits, and Welds

NEMA standards specify the short-time current ratings for air switches and interrupter switches. And it is natural that equipment can be built to meet these requirements when new.

The big "if" is what happens in service.

You have found from experience that switches with conventional contacts must be carefully installed, and then continually maintained if they are to retain their original NEMA short-time ratings. As a practical matter such equipment generally gets little maintenance, and the short-time current capacity falls off.

You want a contact that meets NEMA standards after being in service, in spite of some misalignment in installation, and in spite of little maintenance. The Double-break Alduti has such a contact.

No more expensive contact maintenance work in the shop, dressing off burns and pits. No more worry about contacts welded shut after a momentary short-circuit loading. And the magneto-motive effect through the U-shaped contacts provides extra contact pressure when it is needed.

Specialists in High-Voltage Circuit Interruption Since 1910

S&C ELECTRIC COMPANY

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWS-SCOPE

FUTURE NEWS ▶

New York Power Authority specifications for the 10,000-ft, 115-kv submarine link under Lake Champlain for taking St. Lawrence power to Vermont will call for four, single-conductor, low-pressure, oil-filled cables.

EEI Annual Convention theme will be "The American Way to a Powerful Future." Meeting will be held June 3-5 at the Palmer House in Chicago.

No TVA revenue bond financing bill this year—that's the outlook being bandied around New York's financial district where such bonds would be sold. This probably means that the nation's largest power supplier will have to depend on operating revenue and appropriations for its expansion needs.

Quebec Hydro-Electric Commission is eyeing a deal to sell its publicly owned gas business to a private corporation. The newly-formed Quebec Natural Gas Corp would be the buyer.

Bauxite (aluminum ore) discoveries could give zip to electric power demands in two widely separated areas. The Hawaiian Electric Co will release a report on promising bauxite deposits in its service area. Two U. S. aluminum firms are taking a serious look at bauxite potential in Spartanburg, S. C. area.

LATE NEWS ▶

Recent record-breaking blizzard in Southwest left severed utility facilities in its wake. Electric service was disrupted in Kansas and in the Oklahoma and Texas panhandles. In Texas, REA lines seemed to be the hardest hit.

AEC signs research and development pact with Power Reactor Development Co to build fast breeder reactor at Monroe, Mich. AEC will provide $4,450,000 for work in AEC facilities and waive $5 million in normal charges for fuel costs from signing of pact to 5 years after PRDC gets operator's license.

General Electric Vice Pres Francis K. McCune warns Congress that unless it adopts atomic insurance legislation this year, GE may be forced to halt work on the 180,000-kw, $45-million atomic power plant being built for Commonwealth Edison and Nuclear Power Group near Dresden, Ill.

Mandatory hearings on all future nuclear power and test reactor projects are proposed in bill introduced by Sen Clinton P. Anderson (D-N.M.). The measure would also require public disclosure of all reports of AEC Reactor Safeguards Committee on future projects except those involving classified data.

Central Maine Power Co is denied a $2.3-million rate boost (about $1.8 million a year immediately and $564,000 over a period of years) by Maine PUC.

Gov Albert Rosellini (Wash.) signs bill to permit Tacoma City Light to resume construction of its 460-Mw hydro project on Cowlitz River by removing from 1909 act a clause barring cities from interfering with public navigation.

Congratulations . . . Baltimore Gas & Electric advances J. Theodore Wolfe to president, Austin E. Penn to executive vice president, Raymond H. Arndt to vice president, Alfred P. Ramsey to vice president-general counsel, and C. Edwin Bristor to assistant vice president. Charles P. Crane, former board chairman and president, was re-elected to the board post . . . **Carroll V. Roseberry** is new vice president and manager of Westinghouse Electric Corp's Midwestern region.

ELECTRICAL WEEK

A TWO-MINUTE

EVENTS ▶ **San Francisco earthquake causes less than $10,000 damage** to Pacific Gas & Electric system **(p 48)** . . . California firm organizes to tap underground steam in geyser area for possible production of electric power **(p 42)** . . . Pacific P&L's research program turns up industrial water supplies in unlikely sand dune area **(p 42)** . . . Monongahela Power allocates $500,000 to serve its most unusual load—a radio observatory to be located high in the West Virginia mountains **(p 43)** . . . Army Corps of Engineers report worries with two recent generator additions at McNary project **(p 45)** . . . Congress ponders way to exploit power resources on Trinity River **(p 46).**

ATOMIC PROGRESS ▶ **Nuclear power pioneers are entering a period of "realism"** following an era of rather "rosey optimism." That's the way some observers characterize the papers given at the recent big atomic meetings in Philadelphia. Some 7,000 industrial and business leaders attended. You will have an opinion of your own after reading our full-dress meeting coverage **(p 50).**

GENERATION ▶ **Pacific G&E's Humboldt Bay steam plant is an end-of-the-line station.** It will bolster the power supplies of the company's Humboldt Division, an area previously supplied entirely from long-distance 110-kv transmission. The supplemental and back-up roles of the station made for unusual design requirements. The 110-kv lines will continue to supply the bulk of the power requirements in the area, but the new station is designed to assume full load promptly should either or both of the ties be lost. The unit will be capable of picking up from 5% initial load to nearly full load within 3 seconds and continue operating at 100% load in the event that both ties go down. It'll have 2 minutes to go to full load in the event one tie is lost. For design purposes it was assumed this less severe condition would have to be met ten times annually without damage or increased maintenance. Comprehensive design philosophy story of the Humboldt Bay plant gives much attention to the plant auxiliaries **(p 56).**

TRANSMISSION ▶ **To study the radio influence characteristics of a high voltage line,** the Hydro Electric Power Commission of Ontario rigged up a special noise-producing suspension insulator. Trick was to build a spark gap into the insulator and study the results in the laboratory and in the field **(p 72).**

Crumbling cable reels required quick first aid to keep a transmission line project on schedule. Toledo Edison engineers came to the rescue with a clever metal spider reinforcement (see story and photos on **page 74).**

SUBSTATIONS ▶ **Talk about fast work,** it took Public Service of Indiana 15 days to put up a 100-Mva temporary substation at its Wabash River generating station. When the 135-Mva power transformer carrying the station's No. 5 unit failed, engineers threw up a wood structure, brought in 12 smaller transformers, and hooked them in parallel to form a dependable substation. With a short transmission line, the regular transformer was bypassed for repairs, and unit No. 5 went back on the line **(p 49).**

DISTRIBUTION ▶ **Here's a novel approach to filling in those residential load valleys.** It's keyed to shaving the distribution peaks on a transformer-loading rather than a time basis. For the utility it makes the heavy power-using appliances, such as water heaters, clothes driers, and supplementary space heaters, much more attractive loads. For the customer, it provides much longer periods of off-peak power than would be available with the usual time control devices. Here's how it works: A heat-actuated control triggered by the temperature of the dis-

tribution transformer serving the load opens or closes the controlled circuit in the customer's home. A single pilot wire from the transformer to the customer's controlled circuit does the job. It appears to have worked well on its first field test on Kansas City P&L lines. The liberally-illustrated story is authored by Glenn S. Young, manager of power and lighting sales at that utility. You'll want to take a look at the coincidence of system and distribution peaks as shown on the charts **(p 60).**

The camera replaces the draftsman in helping to reproduce a part of the engineering drawings needed for certain types of utility work. Here's a technique that takes some of the routine out of drawings and saves time **(p 76).**

RELAY & PROTECTION ▶ **Attention relay and protection engineers!** Compare your own relay test sets with the one developed by TVA's electrical laboratory and test branch. The TVA all-purpose set tests current and voltage relays as well as oil circuit breaker contacts. Basically it consists of a source of test current and a means of measuring relay time, but it is both compact and highly versatile **(p 54).**

SELLING ▶ **Switch from steam to electric power means a $14,000 annual savings** to Milton W. Bosley & Co, a wood moulding works in Baltimore. Before Baltimore Gas & Electric engineers came to call, the moulding concern was using a steam plant to power its saws, shapers, and other equipment. Wood scraps from the plant were used for fuel—making it for all outward appearances a pretty economical operation. But the time required to operate and maintain the boiler and turbine along with the shutdowns for needed repairs made it pretty expensive. A 100-hp electric motor has taken away the headaches and made way for the tidy savings . . . Out in Toledo, the supervisor of an elevator plant has devised a motor driven voltage selector for his test area that saves time and reduces errors **(p 84).**

MANAGEMENT ▶ **Outlook for interest rates during remainder of year** is "not much change." Yet there is sufficient money available for most business expansion programs. This week's Electrical Business Outlook **(p 93)** tells of some of the underlying causes of the tight money situation. More important it relates the current money market conditions to electric company needs.

PEOPLE ▶ **At Georgia Power, Earl J. Archbold is new chief electrical engineer,** and Edgar S. Harrison is new chief mechanical engineer. At Florida Power Corp, A. C. Herron is promoted to purchasing agent. At Colorado Rural Electric Association, William B. O'Rourke is acting manager **(pp 102, 103).**

MANUFACTURERS ▶ **New line of vacuum switches with ratings** from 7.5 through 230 kv are on the market. Design is predicated on experience gained from more than a year of successful tests for switching capacitor banks . . . A self-contained 200 Mva, 3-phase, oil circuit recloser moves to market. It is rated 560 amp maximum continuous and is applicable on 2.4 through 14.4 kv systems . . . Full color "Guardians of Power" movie tells the porcelain insulator story **(p 97).**

NEW EQUIPMENT ▶ **New line of 25- and 50-kvar capacitors is introduced.** Individual elements of insulating paper and aluminum foil are set in unit horizontally so container sides act as radiating surface. Factory wired units can be supplied with or without switches . . . Pole-type transformer brackets for mounting 1, 2, or 3 transformers are available in new line . . . They will handle transformers from 15-kva to 167-kva **(p 86).**

ENGINEERING TRENDS

Microwave gains new adaptibility to utility communications with the discovery by U. S. Signal Corps engineers that sharp mountain peaks blocking the line-of-sight transmission path will actually boost signal strength on the receiving side by as much as 100 times for frequencies over 50 Mc. This "obstacle gain", deduced to come from downward diffraction of waves passing over sharp ridges, can now be computed accurately to site transmitting and receiving stations to benefit by its effect.

Gains in British coal production since New Year already exceed the yearly increase predicted by the National Coal Board. Production in 8 weeks of 1957 was 1¼ million tons over the 1956 rate while consumption dropped 0.6 million tons. Continuation of this trend could spur re-evaluation of plans to push electrification of railroads and reduce the urgency of their nuclear program.

EHV above 345 kw will promote the use of 2-step cuts in basic impulse levels. Another full step is seen possible within six to eight years. Thinking in this direction would come easier with the cuts expressed in per cent of full insulation instead of arbitrary steps, two steps below the full 1,550-kv BIL of 345 kv being 32%.

Low-cost digital computers can ease engineer shortage by relieving engineers of the time-consuming repetitive calculations of surveying and equipment design, claims Maurice Horrell of Bendix Aviation.

FROM EDITORS IN THE FIELD

2/0 ACSR is favored as a more economical secondary than the 1/0 formerly used for residential distribution. Indianapolis P&L Co has found that 5% annual growth applied to the load characteristics of new residential areas will justify the higher first cost of the 2/0 conductor.

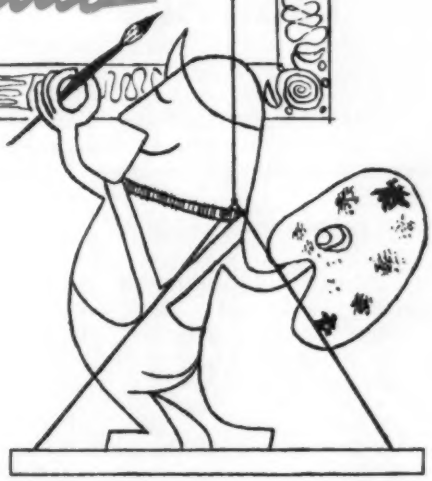
Fly ash sintered into pellets with proper amounts of clay and limestone permits easy, clean storage until ground into cement. First commercial plant to use this process is already in preliminary operation.

Low-cost underground distribution for residential areas gains flexibility with the development by a Southwestern manufacturer of transformers designed to transfer heat directly to the earth in which they are buried. Another manufacturer has adopted plastics to fabricate enclosures for transformers to be used with buried primary and secondary cables.

Cooling towers enable economic use of a bluff for a 100-Mw plant. Kentucky Utilities Co's new E. W. Brown station will depend upon the hydro reservoir 150 ft below the steam plant only to replenish water for the towers, thereby circumventing the power losses of pumping condensing water up the sheer cliff. In Kansas, low water has forced Kansas P&L Co to haul over 60,000 gal of water from wells to replace losses from its Emporia power plant cooling towers.

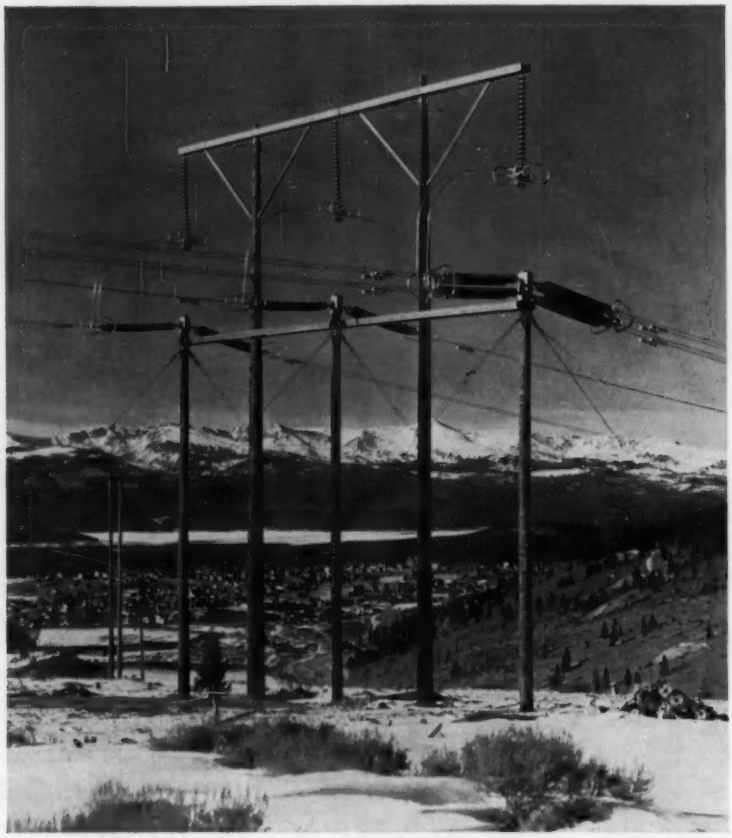
Coming in next week's
Electrical World...The cool and
low VAREX. A new
Product carrying one of the
Electrical Industry's
oldest names.

Ohio Brass



4749-H

Special five-pole deadend which was built so that radio influence choke coils could be used to eliminate interference from secondary lines in the area.



Transmission news is being made at Leadville

Colorado Public Service tests expected to provide basic information on EHV transmission at high altitudes

O-B insulators and hardware are making an important contribution to the extra-high voltage transmission tests at high altitude being conducted by Public Service Company of Colorado at Leadville.

Since the tests are primarily on conductor and conductor arrangement, one of the requirements of the O-B shielding devices was that their radio and corona characteristics be equal to or better than the best supported conductor arrangement. Such shielding devices were developed and their performance tested in the O-B high voltage laboratory before they were sent to Leadville.

Testing on insulators and hardware supplied for Leadville revealed that they need not place any upper limit on transmission voltage magnitude. In other words, you can take voltage as high as you want to. The insulators and hardware can be supplied to handle it.

Ohio Brass is proud to be cooperating in the Leadville experiment because we know valuable information to the power industry will come out of it.

Remember, we're always ready to help you with any problems you may have pertaining to extra-high voltage transmission.

OHIO BRASS COMPANY, MANSFIELD, OHIO
CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Ohio Brass

4747-H

GENERAL ELECTRIC ML-32 STEP VOLTAGE REGULATORS on the line at the substation of a large midwestern utility.

Midwest Utility Finds That General Electric ML-32 Voltage Regulators Require

"PRACTICALLY NO MAINTENANCE"

By Bob Bry, Manager—Marketing Voltage Regulator Product Section

A large midwest electric utility has been installing a great many of our ML-32 step voltage regulators. We asked them why, and here is what they told us:

One of their Division Superintendents said: "I like the ML-32 from the maintenance point of view. There is practically no maintenance as compared with other types or makes of regulation. I feel we save time and money because it isn't as necessary to continually check the G-E regulators."

He feels that big dollar savings have resulted for his company because "installation of the G-E regulators has cut down on the number of maintenance trips we've had to make to outlying areas and the oil field sections."

Another reason for this utility's preference for ML-32 regulators is the G-E Load Bonus which allows them to increase current capacity while the regulator is energized.

Another one of their Division Superintendents put it this way: "I especially like the ML-32's Load Bonus feature because, in cases where the load builds up and exceeds the regulator rating, we can use Load Bonus to obtain a capacity of 160%. In other words, in cases where the load builds up, we set the taps up on the transformer and set the regulator to boost 5% and buck 10%."

Reduced maintenance costs and increased current capacity can save your company money, too. Learn more about this new G-E regulator by asking your G-E representative or by writing Section 423-22, General Electric Co., Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

PRIMARY UNIT SUBSTATIONS

CUSTOM BUILT FOR YOU —AT NO EXTRA COST

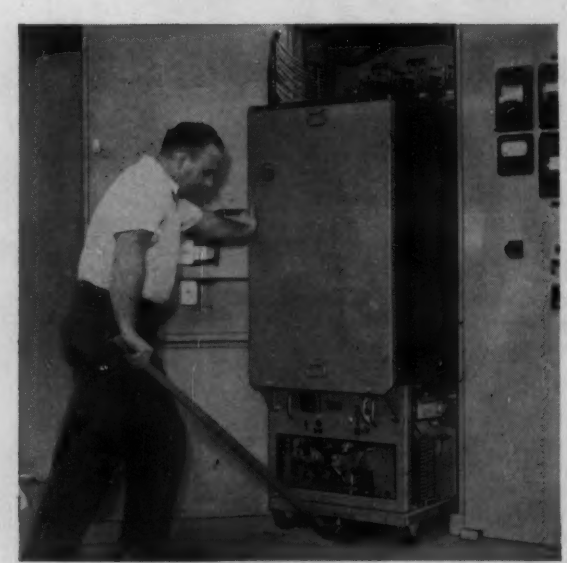
Here at I-T-E, complete primary unit substations are custom designed and engineered to meet your particular requirements. I-T-E engineers skillfully knit together quality I-T-E substation components in a way to give you the advantages of versatility, reliability, safety and convenience.

Particular emphasis is placed on ease of installation to meet all your requirements for growth and relocation, with full regard to an appearance that fits well into your surroundings.

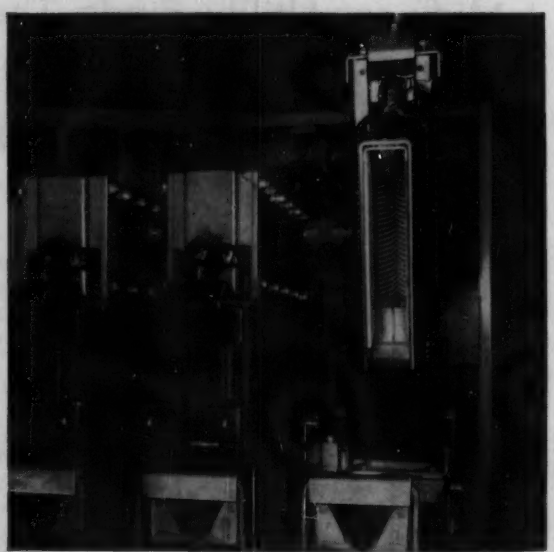
Typical I-T-E quality manufacturing standards further insure that your substation will give you the maximum reliability and performance at the lowest cost. Delivery can be made in accordance with your own construction schedule. You can save time, trouble and money in completing the final job.

I-T-E primary unit substations are available for any application and in any standard rating. For details, call the I-T-E sales office near you. Or write I-T-E Circuit Breaker Co., 19th & Hamilton Sts., Philadelphia 30, Pa.

Engineered to insure the best value

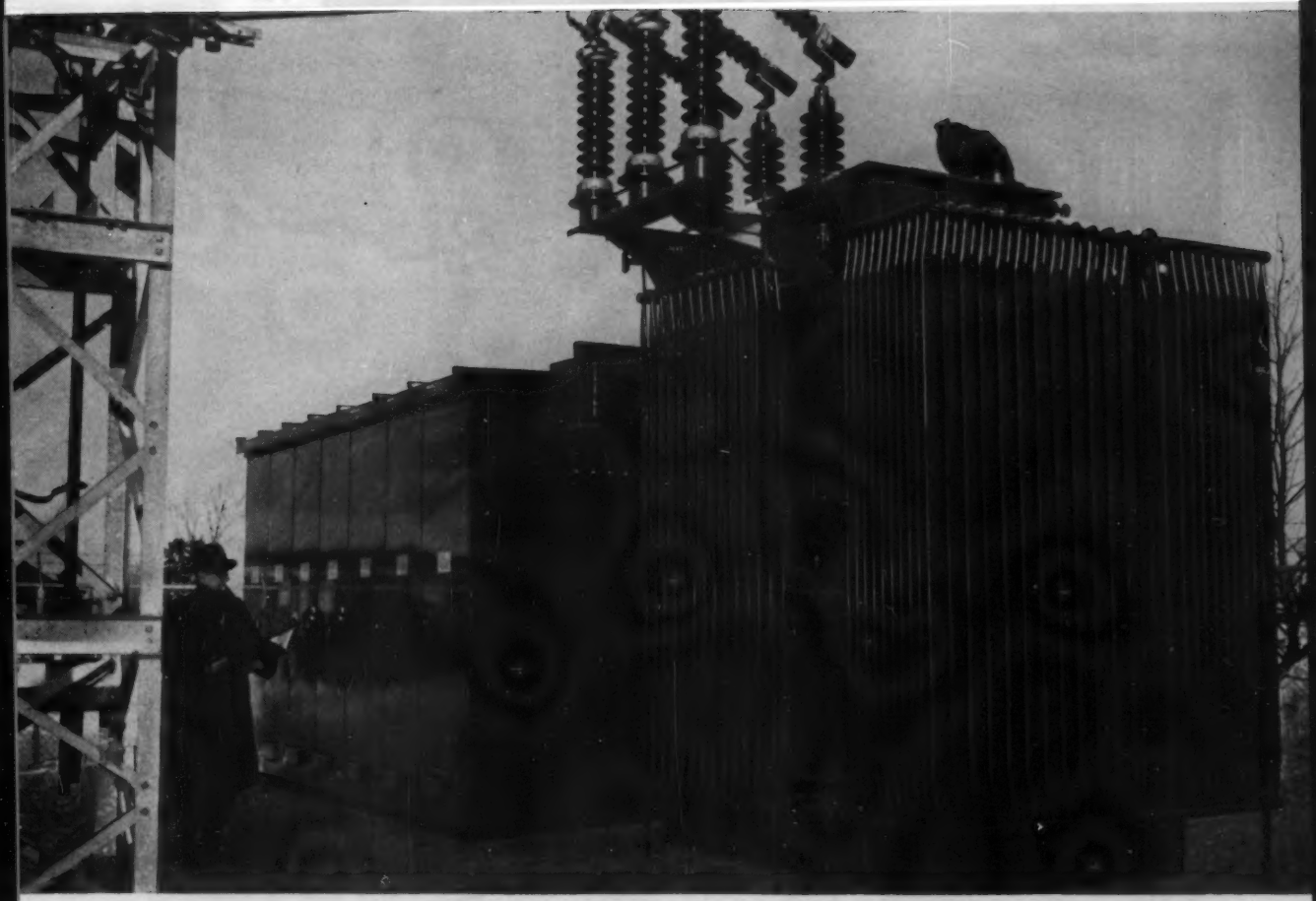


Horizontal drawout air circuit breakers. Even heavy 13.8-kv circuit breakers roll out easily on permanently attached wheels. Safety shutters automatically close over bus openings when breaker is moved to test position or from enclosure.

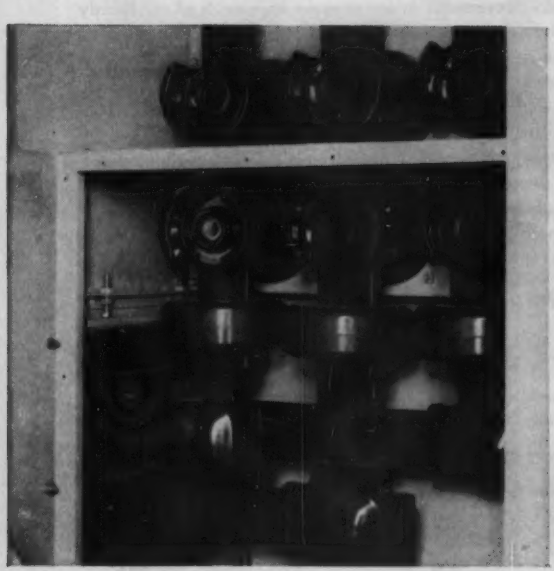


Positive arc interruption. Double coil, closed iron magnetic circuit produces intense magnetic effect, drives arc rapidly and uniformly between plates in arc chute, where it is extinguished, giving faster interruption, longer arc chute life.

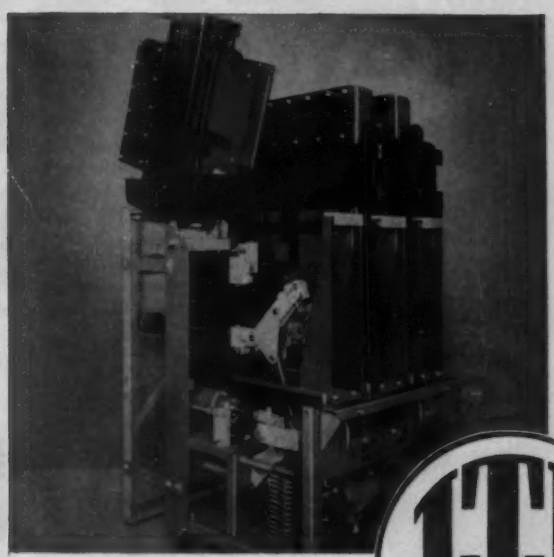
I-T-E CIRCUIT BREAKER COMPANY—Switchgear Division



and the most reliable performance



Fully isolated main bus with flame-retardant insulation. Bus is held in alignment against short circuit stress by porcelain bus supports. Flame-retardant insulation covers entire bus, including porcelain primary disconnect housings.



Simplified maintenance. Pivoting arc chutes simplify routine inspection and upkeep. Auxiliary devices are positioned to permit easy access.

I-T-E

THE HOME

REMEMBER *Our long experience in working with both utilities and the public is your assurance of dependable work and good customer relations.*

THAT TREES BUILT

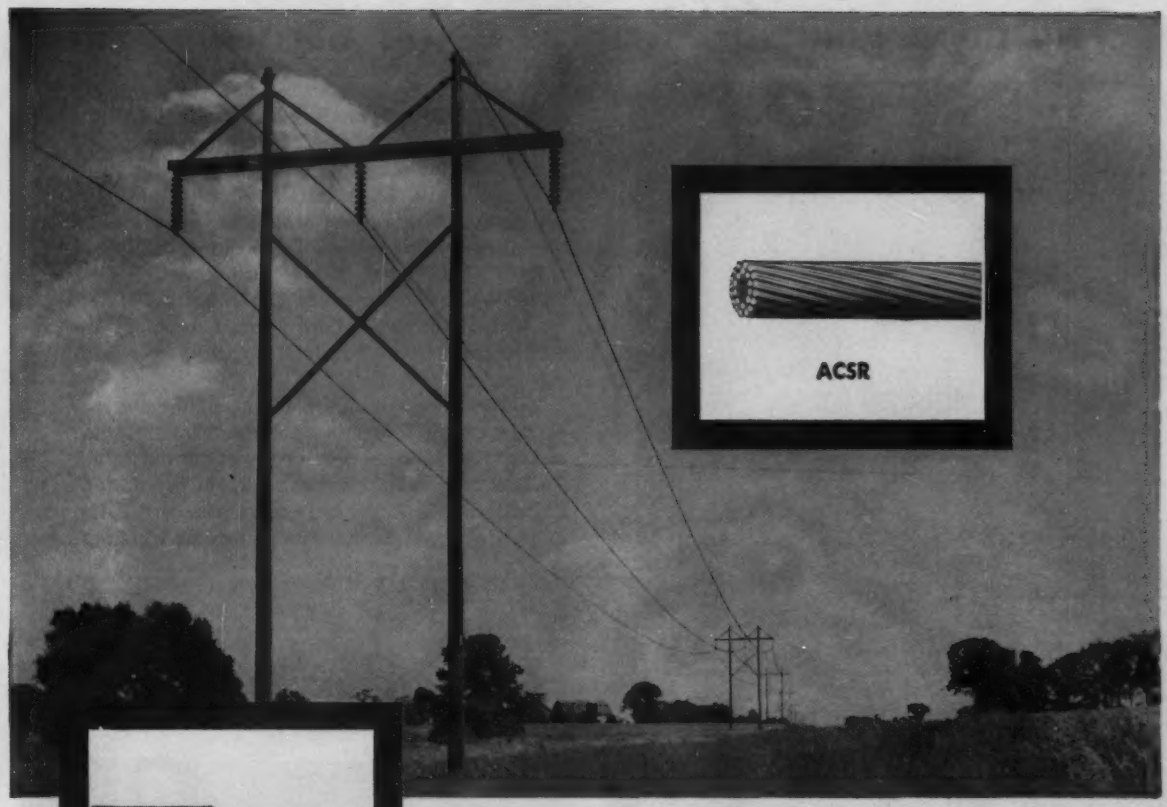
When a company builds a new home office it frequently is asked what factors have been most prominent in its achievements. In our case we owe much of our steady progress to the enthusiasm of thousands of clients both past and present whose loyalty and friendship we value so highly and to the skill and ability of the men and women who have made up the Bartlett organization down through the years. We also take pride in the contribution made by our Research Laboratories. Their continued search for new and better ways to protect shade trees has resulted in many of today's outstanding advances in tree hygiene and preservation. The years ahead, we are sure, will bring forth even greater achievements. We are looking ahead, planning ahead and working ahead so that we shall continue to give those who rely on us the very best in scientific shade tree care both today and tomorrow.

Our new building is more than just a building to us. It is visible approval of the Bartlett Way—the scientific way.

1907-1957 50 years Progress in Scientific Tree Care

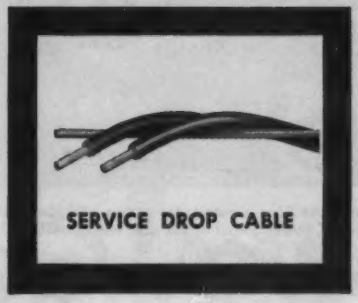
BARTLETT TREE EXPERTS

Home Office, Research Laboratories and Experimental Grounds, Bartlett School of Tree Surgery, Stamford, Conn.
Local Offices from Maine to the Carolinas, and West to Indiana.
See your Local Telephone Directory for Local Address.



GENERAL CABLE

ALECTRAL ALUMINUM CONDUCTORS



Consistent, outstanding performance mark General Cable's ALECTRAL Bare and Insulated aluminum conductors. Manufactured to General Cable's high standards in all sizes. Bare ACSR and aluminum • Weatherproof aluminum and ACSR conductors • All types of service drop cables. ALECTRAL is available with a complete range of paper, rubber and thermoplastic insulations, backed up by over 75 years of General Cable's engineering and manufacturing experience.

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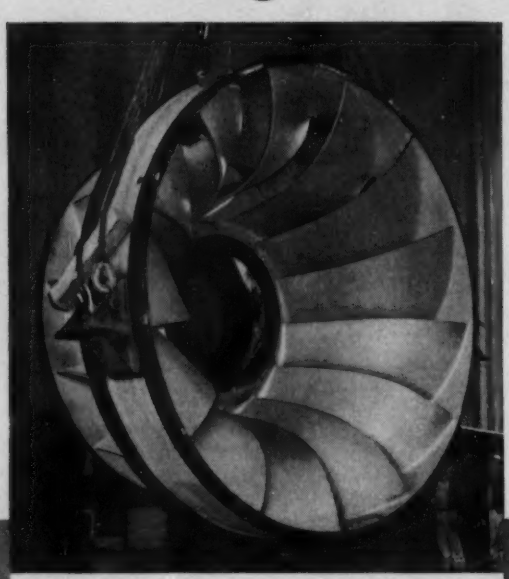
for quality and service . . . specify **GENERAL CABLE**

Two more giant B-L-H turbines for Garrison Dam

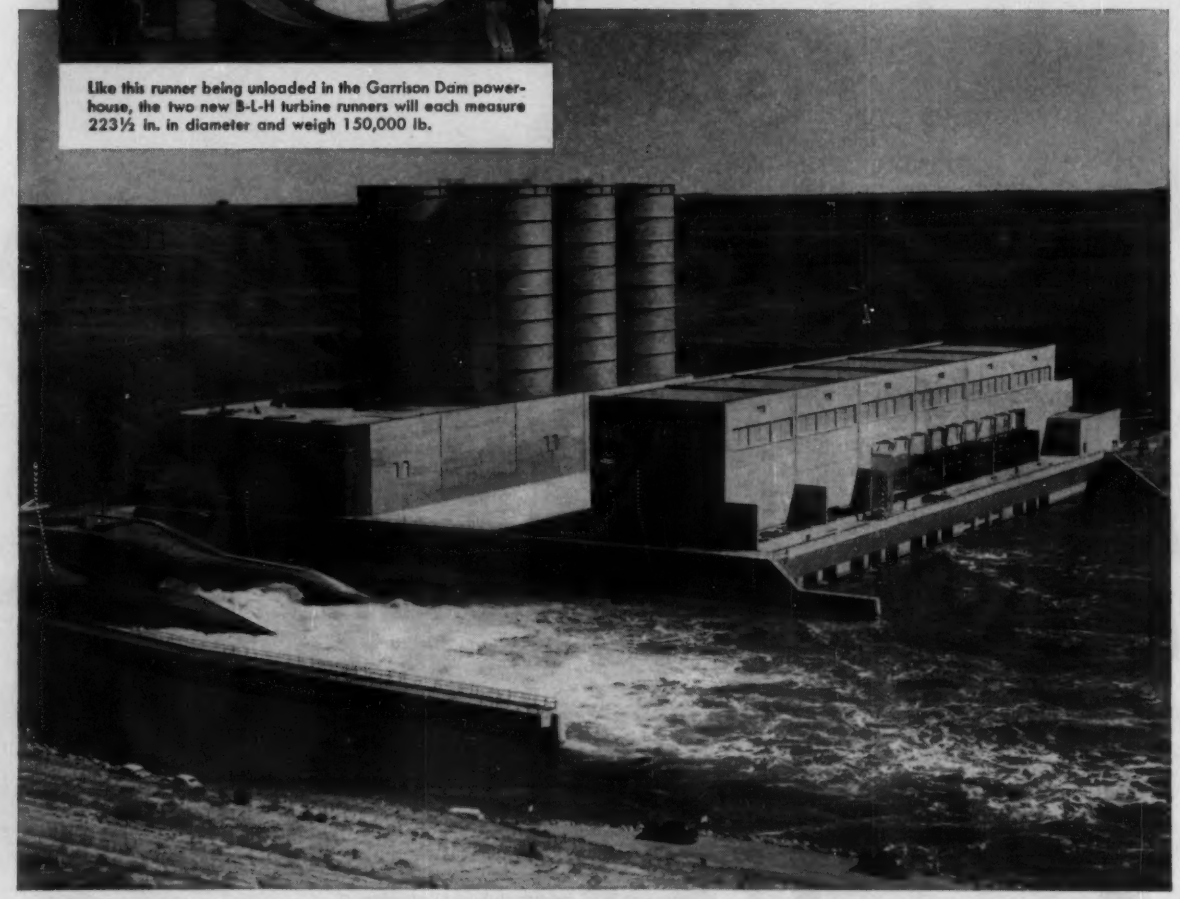


Like this runner being unloaded in the Garrison Dam powerhouse, the two new B-L-H turbine runners will each measure 223½ in. in diameter and weigh 150,000 lb.

With three of its huge Francis-type turbines already in operation at the Garrison Dam on the Missouri River at Riverdale, N.Dak., Baldwin-Lima-Hamilton is now building two more to be delivered in 1958 and 1959. Their installation will mark the completion of a project which encompasses the largest reservoir surface area in the world.

Each of these new B-L-H turbines will deliver 90,000 hp at 90 rpm under 150-ft. head. With all five B-L-H turbines in operation, Garrison Dam will be the source of enough electric power for a city of 1,200,000.

Baldwin-Lima-Hamilton is internationally recognized as the leader in design and manufacture of hydraulic turbines. For a copy of our illustrated Turbine Bulletin 1001, write to B-L-H Corporation, Philadelphia 42, Pa. or to Pelton Division (B-L-H), 2929 Nineteenth Street, San Francisco 10, Calif.



Powerhouse and surge tanks at Garrison Dam, under construction on the Missouri River. Included in work yet to be done is installation of two additional power generating units, the turbines for which are now being built by the Eddystone Division of Baldwin-Lima-Hamilton. Power output of this dam will be 450,000 hp.

BALDWIN · LIMA · HAMILTON

Eddystone Division

Philadelphia 42, Pa.

Hydraulic turbines • Weldments • Dump cars • Nonferrous castings

"Magic Touch"

Lights burn and wheels turn when the magic of electricity surges through industry's life line of high voltage cable. Long, intensive testing has proved beyond question that Simplex ANHYDREX XX insulated cable possesses the stability and resistance that assure long, trouble-free service in all environments. Its amazing resistance to ozone and other oxidizing agents make Simplex ANHYDREX XX the logical choice for your high voltage applications. For complete technical data write for Booklet 1023.

SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.

LIVE BETTER ELECTRICALLY

Simplex

ANHYDREX XX

NEW!

T&B complete COLOR KEYED splicing package speeds line and service work

Now one new UT 5 installing tool is the *only* tool you need to make all line and service compression connections . . . including splicers, taps, and pin terminals. And T & B's color-keying insures accurate, speedy connections on a wide range of copper, aluminum and A. C. S. R. cable. Here's all you do . . . match the color of the die to the color of the connector . . . compress . . . and the joint is made.

Your T & B Distributor will be glad to demonstrate the UT 5 with its many advantages. When you use this one tool you simplify all your line and service work. For further information write for new T & B bulletin.

LOOK FOR THIS SIGN — T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-61

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INCORPORATED

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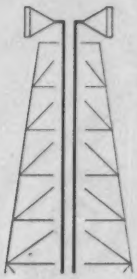
MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

What kind of men develop microwave highways?



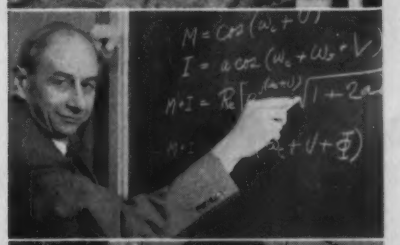
The great microwave systems that relay telephone conversations along with television programs from coast to coast will have to work harder than ever to meet growing demands for service. But at Bell Laboratories scientists have been making important advances in the art of microwave communication. These advances are being applied in the development of a new and more efficient system in which single beams of microwaves will carry simultaneously many more telephone conversations and television programs than is now possible.

The development of the new system demands the varied skills of men in many fields of science and engineering. Just a few of the specialists necessary are . . .

PHYSICISTS like J. A. Weiss, Ph.D. in Physics, Ohio State, to harness the properties of ferrites in new ways for better control of the transmission of microwaves.

MICROWAVE ENGINEERS like P. R. Wickliffe, M.S. in E.E., M.I.T., to design new circuitry. Microwaves must be conducted, controlled and amplified through waveguides which resemble pipes.

MECHANICAL ENGINEERS like W. O. Fullerton, B.S. in E.E., Iowa State, to embody new principles in designing the many structures and devices used in microwave telephony—with all parts feasible to manufacture, practical to install and easy to maintain.

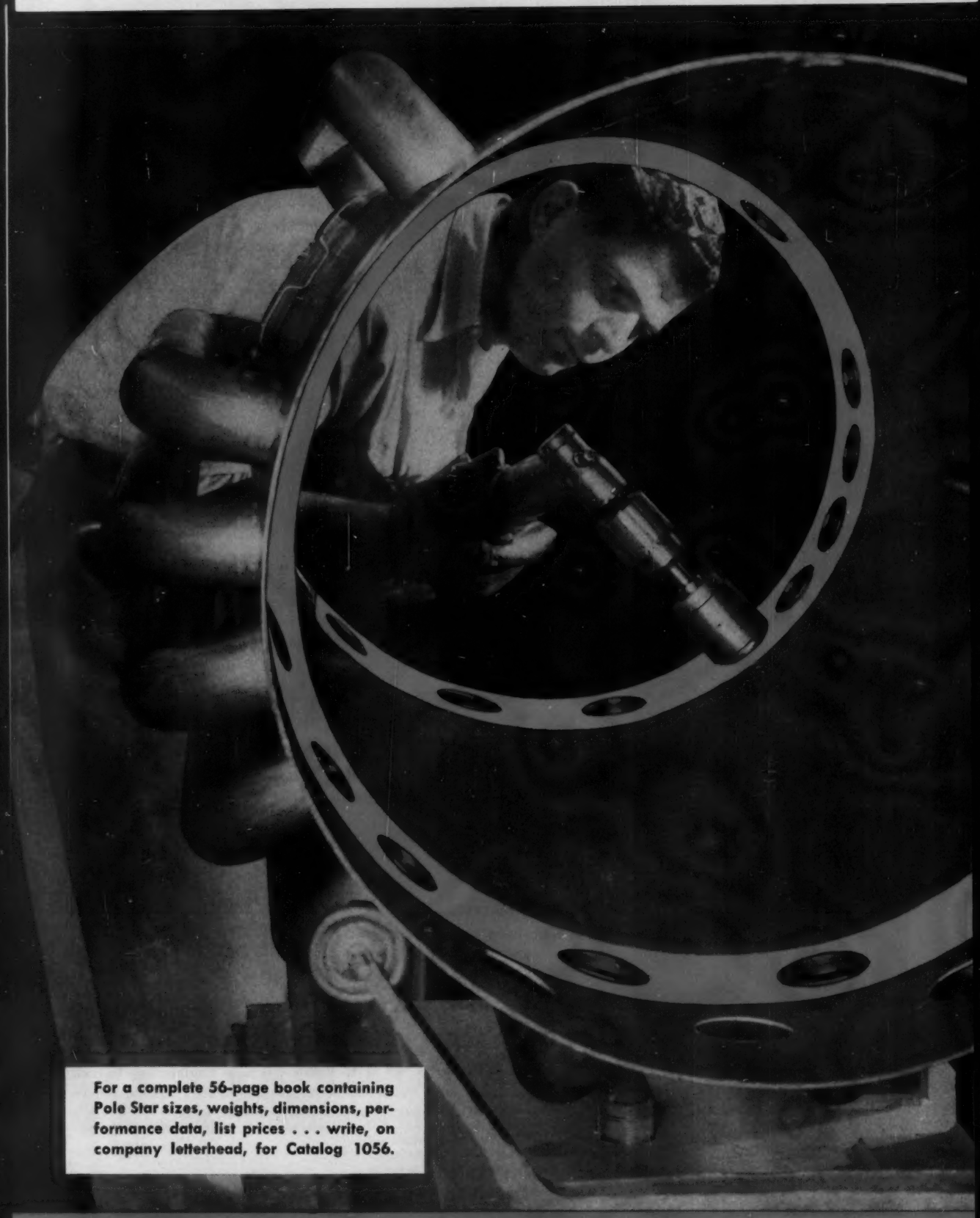


SYSTEMS ANALYSTS like J. P. Kinzer, M.E., Stevens Institute, for over-all system planning and prediction. Mr. Kinzer works with numerical quantities and characteristics to predict on paper the performance of an operating system. What will it do? How must it perform to meet the needs?

ELECTRONIC ENGINEERS like B. C. Bellows, B.S. in Engineering, Cornell, for the development of "watch-dog" equipment to protect against failure. Protective devices must operate automatically in split seconds to maintain uninterrupted service.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT



For a complete 56-page book containing Pole Star sizes, weights, dimensions, performance data, list prices . . . write, on company letterhead, for Catalog 1056.

PENNSYLVANIA TRANSFORMER COMPANY
CANONSBURG, PENNSYLVANIA • Greater Pittsburgh District

'Round and 'round

he goes . . . . to expand

POLE STAR's

high overload capacity

The use of cooling tubes on units 25 kva and larger gives Pole Star distribution transformers the efficient cooling needed for high overload capacity. By providing a "passage-way" out of and then back into the tank, tubes permit a naturally faster — and freer — circulation of oil than is possible with any tubeless design. Heat must pass only through the walls of the tubes before being dispersed into the surrounding atmosphere.

Such efficient cooling contributes to high transformer overload capacity in two ways: by preventing too sharp a rise in temperature whenever the normal operating capacity of the transformer is exceeded, and by quickly dissipating any excessive heat just as soon as possible after the overloading has ceased. The latter point, it should be noted, is extremely important so far as *long range* overload capacity is concerned, since rapid cooling helps prevent potentially harmful sustained periods of overheating.

In keeping with Pennsylvania Transformer Company's insistence upon the highest quality, cooling tubes are given a "double seal" where they enter the tank wall. The ends of the tubes are pneumatically expanded, as pictured, so tightly against the tank wall that there are no external crevices or openings in which moisture might collect. Thus, tube ends can be welded *inside* the tank, where there is ample clearance for a thorough job, and where there can be unhampered inspection of the welded joints.

167 Production Controls make Pole Star Best!

POLE STAR

3 through 500 kva
through 67,000 volts

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CF&I GALVANIZED STEEL STRAND

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EASY AS 1...2...3

to service this 5000-hp, 2-pole motor

Elliott design speeds and simplifies maintenance

1

Maintenance procedure begins with removal of top bracket covers. Two men, without hoist or chain block, can handle the heaviest parts involved.

2

Inner air baffle is in four sections. Two upper sections are easily lifted through opening above lower half bearing bracket.

3

Covers on lower bracket give access to lower air baffles which are rotated into position above shaft, lifted out.

motor is now ready for inspection, cleaning, or treatment

For more complete details on the maintenance of large 2-pole motors, see your Elliott representative or write Elliott Company, Ridgway Division, Ridgway, Pa. Ask for Reprint 64.

The ease of access illustrated here is typical of Elliott advanced designs for customers' special requirements. Upper and lower bearing sleeves are equally accessible. Actually, this motor is easier to service than most competitive machines *one-twentieth* its rating.

ELLIOTT Company

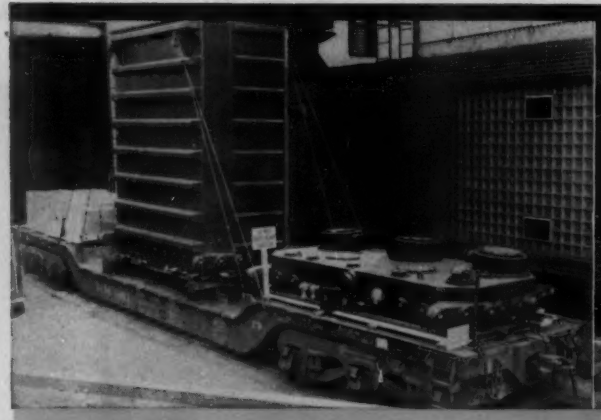
Ridgway Division, RIDGWAY, PENNA.

R 7-4

ADVANCED ENGINEERING DESIGN . . . Wagner engineers, specialists in transformer design, have the skill and experience to design the best possible transformers today—and even better ones tomorrow. This knowledge is incorporated in every special transformer design and in Wagner standardized units as outlined in ASA Standards C57.12b.

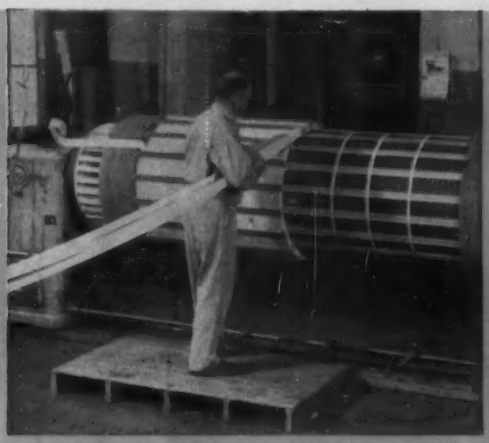
WELL CONSTRUCTED TANKS... Wagner builds all tanks for its transformers. Huge brake presses bend the steel plate smoothly. All seams are uniformly welded by the submerged arc method to insure continuous leak-proof welds that mean longer-lasting transformers.

Quality is what you get in Wagner Power Transformers



SPECIALLY EXPEDITED SHIPPING... Railroad cars are brought right into Wagner's power transformer bay for loading. Main line railroads pass the Wagner plant for expedited shipments to all parts of the country.

FIELD INSTALLATION SERVICE... Wagner field service trucks, manned by trained service engineers, are available, at nominal cost, to help install new transformers, or to make repairs when necessary... another reason why it pays to specify Wagner.



CAREFULLY WOUND COILS... Low voltage helical coils are continuously wound on insulating cylinders of high dielectric strength. High voltage coils are wound with buffer coils at each end for protection against any surges that might be encountered on a properly built transmission line or a substation.

EXACTINGLY BUILT CORES

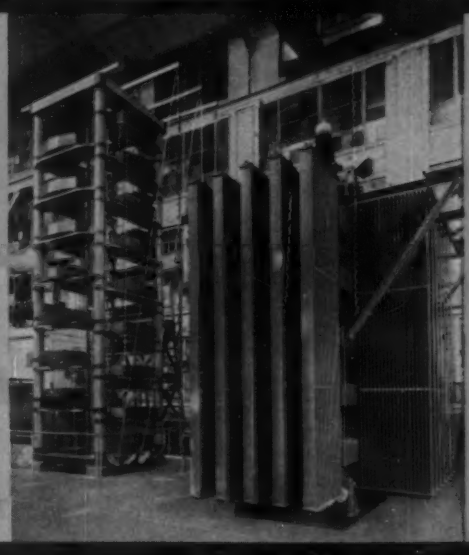
The electrical steel sheets used for core laminations must meet the most rigid specifications. Laminations are annealed at carefully controlled temperatures to assure low core loss. Core laminations, with oil duct spacers, are individually stacked over insulated bolts.

EXPERT ASSEMBLY

Core and coil assemblies are carefully insulated. All moisture and trapped air that might cause hot spots is removed in special vacuum tanks. Extreme care and skill is exercised in every assembly step.

RIGID INSPECTION AND TESTING

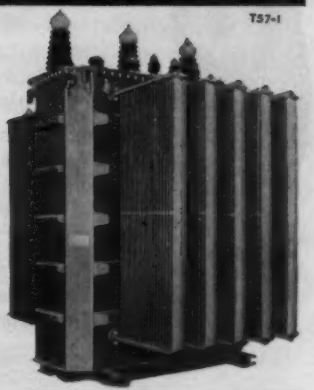
Wagner transformers are given all prescribed commercial tests ...and every new design is subjected to impulse tests to assure that the transformer will perform as designed.



737-1

That's why it's to your advantage to specify Wagner

The extreme care given Wagner Power Transformers—from inception to installation—has one objective . . . to build the best possible transformers that will give you years of completely dependable service. Consult Wagner about your next power transformer installation. Thirty-two branch offices are at your service. Write for Wagner Bulletins TU-181 and TU-16D.



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AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

It Takes a Long Time To Bring Excellence To Maturity*

*Publilius Syrus: 42 B. C.

Samuel Finley Breese Morse:

Morse was a remarkable prophet. In 1868 he wrote, "In commending Kerite especially for telegraphic purposes I would by no means leave out of view its other various applications in the arts no less extensive and useful."

Some 70 years later, Kerite was chosen for a most singular art—the production of the first special cables for the Manhattan Project, Oak Ridge, Tennessee. The Kerite Company was *the only organization* entrusted to design and manufacture 15 entirely new types of cable to help speed the production of the world's first atomic bombs. Never before had flexible cables (more than a million feet) been used on such unusual voltages. The inherited skill and integrity of more than three generations of dedicated Kerite men insures the highest standards of manufacture of all Kerite cable—standards upon which American industry depends.

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29 West Lancaster Avenue, Ardmore, Pa.

EDITORIALS

Are These Today's Ten Commandments for U.S. Nuclear-Electric Power Development?

A Guest Editorial by Theodore Baumeister, Stevens Professor of Mechanical Engineering, Columbia University, and Consulting Power Engineer, New York, N. Y.

Any power engineer, worthy of that identification, is always interested in new developments which might lead to the production of a hphr or a kwhr for less money and with greater reliability, less weight or bulk, more operating flexibility, or improved life of plant. The emphasis on these various items will depend upon the service application of the power plant, eg stationary or transportation, commercial or military.

The atomic power plant is uniquely the most fascinating new development in many years. The service record of the submarine, USS Nautilus, so far as publicly disclosed, demonstrates the reality. Many power engineers have spent much time and money on the possible adaptation of nuclear sources to the generation of electric energy in stationary practice. As a consequence of a study of many published statements and of participation in the design of several projected commercial and non-commercial power plants, it would seem that the following ten tentative conclusions reasonably express the present position of nuclear-electric power in the United States.

1. Present total costs in mills per kwhr in the U. S. are higher on nuclear plants than on alternative plants burning conventional fuels—from 1½ to 10 times as much depending upon the bookkeeping or cost accounting and/or the optimism.

2. Fossil fuel costs will probably increase with the passage of time and changing supply-demand relationships—maybe 2 to 5% per year.

3. Nuclear fuel cost in terms of mills per kwhr should be reduced with the perfection of the breeder reactor and could become zero or even ultimately negative.

4. The extensive reserves of uranium and thorium will preclude the bugbear of depletion and inadequacy of fission fuel resources and supplies.

5. Future total costs per kwhr of nuclear plants should equal or eclipse the then best practice in conventional plants—maybe in 15, 20, or 25 years.

6. Government monopoly and/or subsidy of fissionable materials, heavy water, waste disposal, and the like must be scrutinized and supplemented by the establishment of a free market somewhere if the real costs per kwhr are to be determined.

7. The choice, at this time, of the "best" reactor designs or reactor power plant designs, from among the hundreds of possible permutations and combinations of technical elements, requires omniscience or the most improbable good fortune.

8. The waste disposal problem, in the light of the biological dictum that "no radiation is good," must be solved as it eclipses anything in potential hazards and nuisances that the human race has ever encountered.

9. Safety and containment must be made technically sound and economically feasible; adequate insurance and indemnity must be provided, especially general business and third-party liability protection.

10. We should not be mousetrapped into a play in the international nuclear-electric power ball-game with our present world leadership in the electric energy field and thus sacrifice the blessings of vast attractive coal deposits, mineable at prices which make others jealous. We should not allow political considerations to divert or dilute our leadership in the atomic weapons' field.

Research and development, coupled with the experience gained on naval, military, and early commercial atomic plants, will ultimately have important repercussions in all areas of nuclear fission, particularly electric power.

The power engineer should, today, approach the field of reliable, economic, electric energy from nuclear sources in the U. S. with an attitude which can be briefly expressed—dubious as to the present, sanguine as to the future.

Geothermal Power Project Launched in Calif.

Thermal Power Co, a new firm, is to drill test wells in Big Geysers region. PG&E says power station must develop 12.5 Mw to justify transmission line

A venture which may lead to the nation's first geothermal power development has been launched in San Francisco with formation of Thermal Power Co.

The firm plans to drill three wells in the Big Geysers area near Healdsburg, Calif., to determine whether it would be economic to tap the geothermal steam resources there to run the turbines of a power plant.

If results are favorable, the firm hopes to reach an agreement with Pacific Gas & Electric Co for sale of power to the utility.

Dan A. McMillan, Jr, president of the new firm, said PG&E has indicated Thermal would have to build a plant with capacity of at least 12.5 Mw to justify construction of a transmission line.

The new company has just announced a public stock offering of 199,998 shares at $1 a share to finance the drilling program. The wells will give the company a better idea of the quantity of steam available and how long it is likely to last.

Heat Source Appears Good

Roger Rhoades of San Francisco, one of several consulting geologists who have examined the area, reported that the heat source appears to be deep and large enough to last for hundreds or thousands of years. The big question, he said, is whether underground channels are open enough to admit the necessary amount of water to the heat source.

Eight shallow wells have been operating in the area for 30 years, blowing steam into the air at a pressure of 60 psi and volume of 25,000 to 50,000 lb per hour.

The steam has such a small corrosive content that Thermal Power believes no unusual protective measures would be needed for steam turbines. McMillan claims the field has the best quality geothermal steam in the world.

If Thermal decides to go ahead with the project it will build a generating plant and drill additional wells to supply it.

Earl F. English, Thermal's consulting engineer and former vice-president of Bechtel International Corp, said the California source is similar to those developed successfully in Italy and New Zealand.

Sand Dunes May Yield Industrial Water

Pacific Power & Light's $250,000 research program reveals more water under dunes than anticipated. Expansion of local industries now possible

Pacific Power & Light Co has found "presence of substantially greater water supply" in the sand dune area north of Coos Bay, Ore., than was indicated in earlier studies, reports Paul B. McKee, president.

"The area gives great promise of providing an industrial water supply adequate to support a major expansion of pulp and paper manufacture around Coos Bay," he said.

"Drillings show the water-bearing sands extend much deeper than believed initially, and the inflow from inland sources is large in volume," McKee said.

PP&L has been conducting investigations of ground water resources in the area for the past 14 months. McKee's announcement caps a $250,000 research project aimed at stimulating the area's industrial economy.

Ted Davenport, PP&L project engineer, said earlier that it appears a water yield of 100 million gpd may be possible. He said he thought water could be extracted from dunes at an "attractive" cost.

A U. S. Department of Interior geological survey report by S. G. Brown and R. C. Newcomb appeared simultaneously with McKee's announcement. It gives findings of 1954-56 investigation made by the geological survey in cooperation with Oregon's state engineer.

The report indicates that the ground-water body is recharged by infiltration of about 75% of annual rainfall averaging 61 inches a year. This amounts to approximately 2 million gallons per day per square mile.

Special wells and types of drains are required for efficient withdrawal because of the flatness of the water body and the uniform, medium grain of the sand.

PAUL McKEE: Helping industry grow

The water is soft and has a low mineral content. In a few places its iron content and a light-brown color indicate need for treatment to make it suitable for most uses.

Monongahela to Serve A Most Unusual Load

- **West Virginia utility budgets $½ million to serve the national radio astronomy center in remote mountain area**

- **It'll have an ultimate peak demand of 2,000 kw although normal loading will be less than a quarter of that**

Most unusual item in Monongahela Power Co's 1957-'59 construction budget reads like this:

"Service to radio astronomy center at Green Bank (W. Va.), $500,000."

That's a hefty capital outlay to serve a single customer, but then, this is a very special customer with some pretty unusual requirements. It will be the national radio astronomy observatory sponsored by the National Science Foundation and administered by the Associated Universities, Inc. Architectural and design engineers are expected to be chosen within a few weeks.

Telescope to Be Surrounded by Mountains

In a bowl-shaped depression high in the West Virginia mountains, the observatory will eventually include several radio telescopes, such as the one pictured above, for the study of stars, planets, and the phenomona of outer space. These giant, highly directional antenna will be able to pick up radio wave emissions from trillions of miles out in space. The saucer-shaped antenna now in the program for the observatory will be 140 ft in diameter, second in size only to the 250-ft giant now under construction in Great Britain. They have to be positioned in much the same way as an optical telescope.

Engineers Guess at Its Power Requirements

Power requirements for the observatory can be only tentatively set at this stage. Connected load will include the usual laboratory demand plus that required for driving and controlling the radio telescopes. The 140-ft instrument, which is to be built first, will require an estimated 320 hp motor for fast slewing. Larger telescopes would have larger demands—perhaps as much as 1,000 hp. Normal tracking will require less than 10% of this power.

Estimated load for the air-conditioned building and associated equipment, such as a computer that is being considered, will run between 500 and 600 kw. Estimated peak load for the entire installation when finally completed will be in the range of 1,500 to 2,000 kw.

Because radio interference from earthbound power apparatus could upset all the astronomical studies, the tolerable interference levels have been set at six micro-micro volts/meter/cycle/second at the receivers. These will normally operate in the frequency range of from 200 to 10,000 megacycles.

FIRST RADIO TELESCOPE at new center will be similar to but larger than Harvard Observatory's 60-footer, above

3-Mi U-G Cable Run to Minimize Interference

In order to keep below these levels it was at first thought that exposed distribution facilities in line-of-sight would have to be kept at least five miles from the nearest telescope. Accordingly, Monongahela has made tentative provision to bring the service in from the far side of a small mountain and run it underground for a three-mile distance. Tests have shown that interference may also come from the use of household appliances. This is a local problem which must be solved by the observatory in cooperation with the few valley residents.

Isolated Location Poses Other Problems

Relatively isolated location of the observatory poses additional problems for the power supplier. As presently proposed, Monongahela would start from its Elkins substation, run a 39-mile, 69-kv line extension to a 2,500-kva, 66 to 12-kv regulated substation near Green Bank. From this point, a 12-kv circuit would extend over or through a ridge to the observatory. If necessary, a three-mile section of this line will be underground.

First 15 miles of the 69-kv line would be constructed up the broad flat Tygart Valley to Huttonsville. At this point, the line makes an abrupt change in its course and climbs the rugged Cheat Mountain to a plateau on the top. It then dips into the valley of Greenbrier to a terminal point near Hosterman where the regulated substation would be located.

AEC Unit Finds Atom Power Industry Safe

The atomic power industry will be a lot safer than most industries if a current report by Atomic Energy Commission proves correct.

The report—result of a study of nuclear accident possibilities made at the request of the Joint Committee on Atomic Energy—is bound to affect liability.

The report was issued as JCAE began hearings last week on liability insurance bills sponsored by Sen Clinton P. Anderson (D-N. M.) and Melvin Price (D-Ill.).

Without extensive past experience of reactor accidents to go by, the study group of AEC experts had to make assumptions. For this purpose they chose combinations of the worst possible conditions.

AEC Chairman Lewis Strauss told JCAE if similar studies of other industries were made, "we might be startled to learn what the consequences of 'conceivable' major catastrophic accidents . . . could be." Their actual safety records stand in marked contrast, he added.

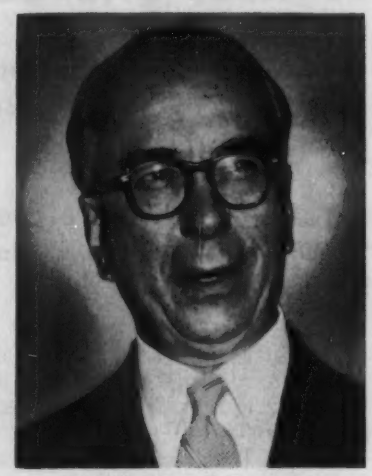
On the basis of existing experience, the study found in over 100 reactor years of regular operation there had been no personal injury nor significant deposition of radioactivity outside the plant area.

The study made findings on both the possible consequences and the probability of major accidents.

For purposes of consequences, they assumed a "typical power reactor" of 500 Mw thermal power in a "characteristic power reactor location" and with 180 days of operation to give full fission product inventories.

Theoretical estimates show personal damage from an accident might range from zero to 3,400 killed and 43,000 injured.

If there were 100 large power reactors operating in the U. S., the most pessimistic possibility means there would be less than one chance in 50 million of being killed in any year in a reactor accident.



STRAUSS: Figures the angles

What FPC Staff's Recent Decision Means

V. CRAIG RICHTER
Washington Correspondent

Although the Federal Power Commission staff has made a recommendation with respect to Pacific Northwest Power Co's license application for the Mountain Sheep-Pleasant Valley hydro project on the Snake River, the final disposition of the case still has some distance to go.

While the brief should not be regarded as the final word awaiting only full Commission approval, it is important in that it gives advance indication of what FPC thinking might be on a given case.

Theoretically a staff brief carries no more weight than do the briefs of the applicant and intervenors. It is only one of a series of steps in FPC decision-making. These steps are well calculated to permit a thoroughly considered decision in a field where decisions often are loaded with dynamite.

In general, this is the procedure before final word is given:

1. Staff findings on an application involving a hearing must be based on the record of that hearing. The staff brief, plus the briefs of the applicant and any intervenors then become part of the record.

2. The hearing examiner issues a decision based on the hearing record plus the above briefs.

3. The full commission then has record, briefs, and examiner's decision to consider in reaching its judgment. In addition, there are generally added to the record exceptions to briefs. If FPC wishes, it can also hear oral arguments on points that need clarifying.

In this chain, however, it is still the FPC staff, engineers, lawyers, and other experts who dig up the facts. Usually this information becomes part of the hearing record and often is the result of months of field work carried on in advance of hearings.

Staff work is important too because of Federal Power Act requirements. Significant in hydro development cases are the right of FPC to recommend federal development, if in its judgment this is needed, and to determine whether a project is best suited for comprehensive development of a specific site.

Yet, a final decision is not necessarily a simple matter of totaling up two columns of figures and ruling in favor of the largest sum.

In the MS-PV decision, the commissioners will have to consider a factor not reflected in any engineering figures: Will the public interest be best served by immediate development of MS-PV, or by reserving this stretch of the Snake for uncertain future Congressional action.

Nez Perce, says the FPC staff, is economically superior to MS-PV only if built within ten years after MS-PV could go into operation.

Corps Delays Acceptance of McNary Units

Rotor temperature of two generators are higher than specified for normal load. Manufacturer says fans will be modified to correct conditions

The U. S. Army Corps of Engineers has delayed final acceptance of the last two hydro-generators, units 13 and 14, at McNary Dam, it was reported last week. Installation of these generators, which are rated 73,684 kva, 0.9 pf, 85.7 rpm, was completed during December, 1956. Since that time the machines have been in commercial operation, pending modification by the manufacturer to meet specification requirements with respect to rotor operating temperature rise at normal rating.

Specs Call for 60C Rise

Corps of Engineers specifications call for these generators to operate continuously at normal rating with a rotor temperature rise above ambient not to exceed 60C; and also to operate continuously at a maximum of 115% normal rating with a rotor temperature rise not to exceed 80C.

In a statement to Electrical World last week, English Electric Export & Trading Co, Ltd, said:

"The generators are in all respects within the specified maximum temperature rise (including 80C rise in the rotor) at the specified maximum loading of 115% of rating, but the rotor temperature rise is somewhat above the specified temperature rise of 60C at 100%. The rotor cooling fans will be modified to correct this condition. But meanwhile, English Electric Export & Trading Co, suppliers of the generators, has authorized the Corps of Engineers to operate the machines commercially and continuously at 115% of rating."

Acceptance Will Be Delayed

North Pacific Div of the Corps of Engineers said final acceptance and payment will be delayed until modifications have been completed and final characteristics determined.

The two 70,000-kw units were turned over to operations for normal commercial service Feb. 8, 1957. Original contract dates for commercial operation was Sept. 1, 1956, for Unit 13, and Dec. 1, 1956, for Unit 14. Because of other considerations, contract is in process of being modified to Dec. 1, 1956, for both units, it was stated.

These units were still in construction stages from Dec. 1, 1956, to Jan. 1, 1957. From Jan. 1 to Jan. 18, the units were in commercial operation about 2% of the time. From Jan. 19 to Feb. 8, they were in commercial operation about 40% of the time. Remaining time in both periods was taken up by tests, adjustments, and modifications necessitated by failure to meet contract requirements for rotor temperature rise, Army engineers said.

Revenue loss so far, if any, according to the North Pacific Div, would only be due to reduction in peaking capacity as all available water was used with existing units during delay periods.

N. M. Co-op Blacks Out . . .

. . . as generator trips off at peak load and ties fail to provide adequate power

Modifications were completed March 16 at Plains Electric Generating & Transmission Cooperative, Inc, to prevent a recurrence of a breakdown which blacked out a number of New Mexico communities four days earlier.

Plains Electric's plant at Algodones—22 mi north of Albuquerque—"kicked out" at peak-load hour, 6 PM, disrupting electric service to at least 10 northern New Mexico and southern Colorado towns. The $10 million REA co-op at Algodones feeds electricity to more than a dozen co-op systems extending from the Mexican border to the mountainous area of southern Colorado.

Turbine Throttle Trips Relay

Exact cause of the breakdown was not determined until Robert A. Pehrson, service supervisor with The Elliott Co, of Jennette, Pa., builder of the 16,000-kw turbine, completed his inspection and modifications March 16.

He reported the turbine throttle had tripped the operating turbine axial protective relay. This, in turn, tripped oil breaker switches, disconnecting the generator from the outgoing transmission line.

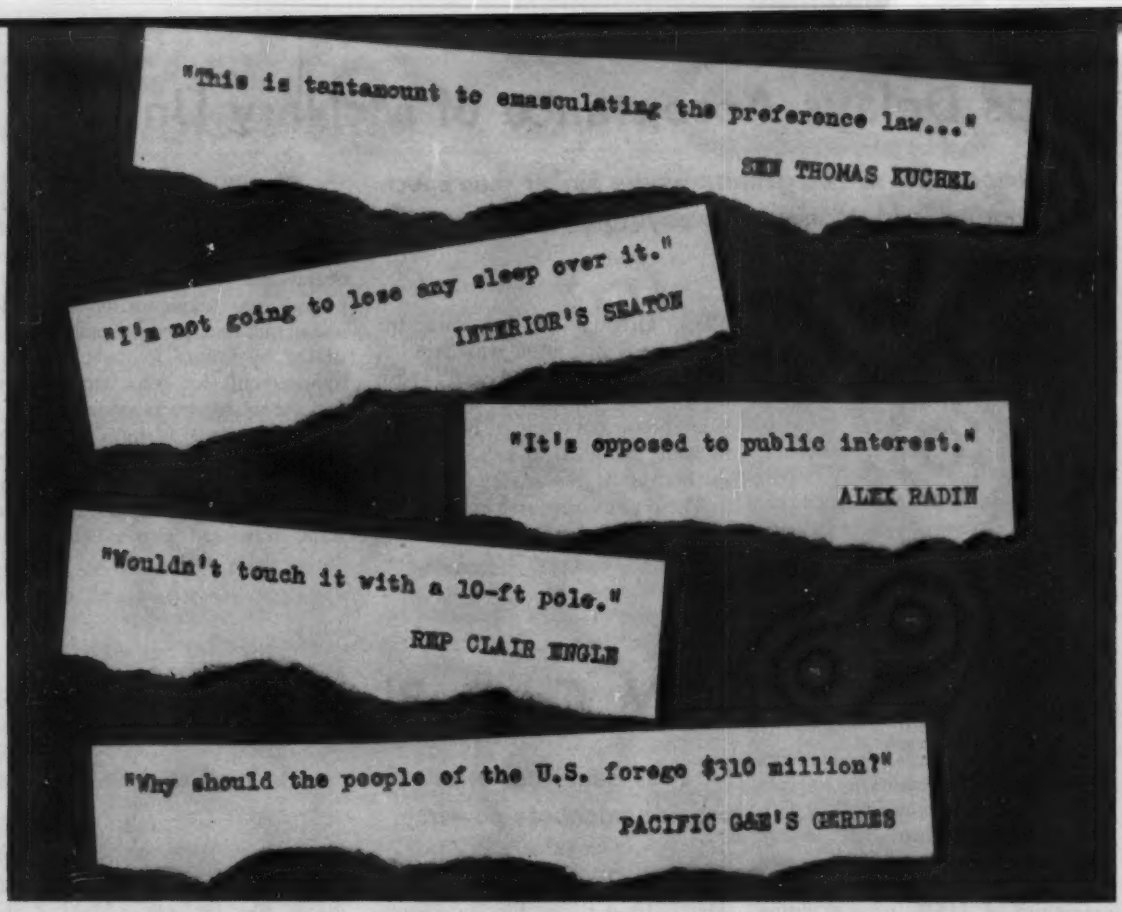
Norton Davis, manager of the Plains Electric system, said it required about 2 hr 45 min to restore service after the generator "kicked out."

Ties Temporarily Inadequate

Through its interconnection with Public Service Co of New Mexico, Plains Electric was able to restore electricity to affected areas. However, Public Service Co was unable immediately to pick up the whole Plains system because the breakdown came at peak-load hour. Also hampering Public Service Co was the fact that one of its generators was out of service while being overhauled.

At its southern end, the Plains system usually is inter-connected through the Bureau of Reclamation's system to El Paso Electric Co. However, the Bureau of Reclamation is reconductoring its line from Socorro to Las Cruces (EW, March 25, p 98) and the connection between the two systems has been open.

The interruption affected eight New Mexico towns and two in southern Colorado which get their power through the Springer (N. M.) Electric cooperative.


"This is tantamount to emasculating the preference law..."
SEN THOMAS KUCHEL
"I'm not going to lose any sleep over it."
INTERIOR'S SEATON
"It's opposed to public interest."
ALEX RADIN
"Wouldn't touch it with a 10-ft pole."
REP CLAIR ENGLE
"Why should the people of the U.S. forego $310 million?"
PACIFIC G&E'S GERDES

Congress Eyes Trinity Partnership

Senate and House units begin study of Interior plan which would permit Pacific Gas & Electric to build and operate power plants at federal project

Staffs of Senate and House Interior Committees have begun work on Interior Secretary Fred A. Seaton's recent proposal for partnership development of California's Trinity River project.

Seaton's recommendation, which urged that Congress accept Pacific Gas & Electric Co's offer to construct and operate the power facilities of the Bureau of Reclamation project, met with some opposition from Congress and spokesmen of the California State Grange and American Public Power Association.

But the partnership plan proposed by Seaton was certain to attract the attention of the hard-pressed lawmakers searching for ways to cut federal spending. Besides the initial capital savings of $56.9 million, the plan also offered returns to the Treasury totalling $250 million in taxes and sales of falling water.

Under the proposal, PG&E would spend $56.9 million for construction of electric facilities and pay the government for falling water during a 50-year period. PG&E's proposed $56.9-million expenditure would be deducted from the $225 million the government would have spent under an all-federal project. After 50 years, the government would have option of acquiring power facilities.

The proposal has now gone to the Congressional staffs, who have been instructed to study all details of the Seaton recommendation. It is believed the study is directed more at checking on Seaton's figures than at anything else.

If the power features are to be handled by the government, the money would have to be provided in the 1959 budget. Therefore some action will have to be taken on Trinity this year.

If Congress approves PG&E's offer, Trinity would reportedly be the first reclamation project owned and operated partly by the government, partly by a private utility.

The project basically is a water conservation scheme, storing 2.5 million acre-ft of Trinity River water for diversion. Average annual diversion for downstream irrigation would be about 865,000 acre-ft.

The power phase of the project, from Reclamation's viewpoint, is strictly a by-product, helping to defray the costs of reclamation.

PG&E made a formal offer in 1955, to construct the 233-Mw power facilities. The company estimated capital investment savings to the government at about $50 million. It offered to pay a flat $3.5-million annually to the government

for use of falling water. This would result in $36 million net revenue to the government over the 50-year period. In addition, the company estimated its taxes on power facilities over the period would yield $70 million to the federal and $65 million to state and local governments.

House Sets the Stage

The House Committee amended its '55 bill to provide that Interior was authorized to "continue to a conclusion the engineering studies and negotiations with any non-federal agency with respect to proposals to purchase falling water . . ." and report the results within 18 months. Both houses passed the bill as amended.

President Eisenhower signed the bill into law in August, 1955, thereby setting a deadline of February, 1957, for Interior's report.

Next step was a restudy by PG&E and Reclamation of the project as modified to provide for added irrigation and to modify the partnership plan to conform thereto. Cooperative work began in March, 1956, when USBR completed revision of its original plans to add Whiskeytown Reservoir on Clear Creek to provide 250,000 acre-ft of storage for irrigation flows downstream on Clear Creek.

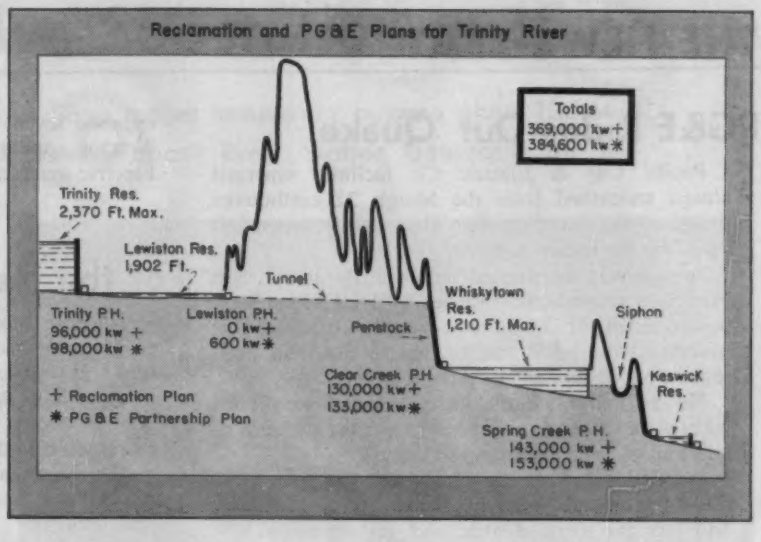
It was agreed that, regardless of who constructed the power facilities, generating capacity should be installed to take advantage of a peaking operation by integration with PG&E's system and therefore must be higher than USBR's original 233-Mw estimate. At Reclamation's request, Congress increased the limit to 400 Mw. Finally, a partnership plan evolved.

Seaton Favors PG&E Plan

The hammered-out plan, signed by Seaton, presents two alternates—one applying if Reclamation constructs all facilities, the other if PG&E constructs the power plants, all tailraces except for Trinity Dam, and all transmission facilities.

Seaton recommended adoption of the latter alternate.

The report declares that overall project cost is about $225 million. Under partnership, the government would pay $168.5 million; PG&E, $56.9 million. Over the 50-year period, the U. S. Treasury would net $165 million more in falling water payments and savings in annual costs than it would have received in power payments if USBR built the entire project. PG&E would pay about $83 million federal and $62 million state and local taxes over the period. Total of the tax and net falling water revenues is $310 million.



Dam and tunnel designs are identical in each alternate. PG&E would install 384.6 Mw of generation, USBR 369.0. Corresponding differences, from 2 to 10%, appear in estimated amounts of total dependable capacity and average total annual kwhr.

The report recommends a complex schedule of falling water payments, replacing PG&E's original proposal of a flat annual sum. Each dam would have separate payment schedules.

Under the partnership plan, nonfederal preference agencies would pay $56.5 million higher and federal agencies $29.5 million higher power bills during the 50 years than if USBR built power facilities and raised the preference customer limit to 650 Mw. But PG&E claims the higher federal agency power bill is more than counter balanced by the PG&E federal taxes of $83 million and said there is no good reason why the people of the U. S. should forego $310 million in order to give away a smaller amount to a few privileged electric customers in the Central Valley.

No Profit on Falling Water

Opponents of partnership development of Trinity have charged that Pacific Gas & Electric Co would make a "profit" on falling water made available by federal investment in dams and tunnels. PG&E would pay for the use of falling water in hydro plants it would build and pay for itself. Payments are equivalent to $5.35 per acre-ft.

PG&E would be buying the use of the water just as it buys gas or oil for use in steam plants. Under regulations of the California Public Utilities Commission, the company is entitled to recover—at no profit—its operating costs, such as the cost of gas, oil, manpower, and use of falling water.

The only profit, or return on its money invested, allowed is a fixed return on money invested in equipment and facilities used and useful in supplying electricity. There is no profit, either claimed by the company or allowed by regulatory law, on falling water purchased.

PG&E Rides Out 'Quake

Pacific Gas & Electric Co facilities emerged almost unscathed from the March 22 earthquake that gave the San Francisco Bay area its worst jolt since the big quake of 1906.

Service was interrupted momentarily at two San Francisco substations. At nearby Half Moon Bay, power failed for 30 minutes—until substation personnel discovered it was because a fuse had been shaken out of its holder by the temblor.

No distribution circuits were cut, but some service wires were snapped. In several areas the shake shattered glass envelopes of street lights.

PG&E losses from the quake were less than $10,000—including damage to electric and gas facilities and pay for extra electric and gas crewmen who worked during the emergency period.

The area was jarred by 84 temblors in one day. The most severe registered 5.5 on the Richter scale, compared with 8.25 for the 1906 earthquake.

Watching Ash Disposal

In Tennessee Valley Authority steam plants, the ash disposal line is turned 90 deg after the abrasive action of the ash wears thin the pipe, reports TVA and Tennessee Valley Trades and Labor Council. But it is hard to look at the outside of a pipe and know when the inside has worn thin.

A steamfitter at the Kingston plant has solved this problem. He suggested drilling ⅛-in. holes partly through the pipe. The holes are spaced every 4 ft along four sides of the 10-in. line. When the pipe is worn, the bottom holes begin leaking, signifying that it's time to turn the pipe. After the pipe is twisted, the leaking holes are pad-welded and the pipe stays put until the new row of bottom holes begins leaking.

Proxy Fight: Part III

The fight for proxies is coming to a boil in St. Louis. Union Electric Co mailed early last week—with Securities Exchange Commission's official OK—its proxy material aimed at re-electing the utility's present management.

Union Electric's opposition is St. Louis Attorney J. Raymond Dyer, who seeks to elect new management as an outgrowth of the $35,000 that the utility paid a legislative agent (EW, Jan. 7, p 46). Dyer submitted a number of proposals relating to rights of minors, company advertising, and stockholder relations. These were omitted from the proxy statement as "not proper subjects" for stockholder action.

However the utility did include eight by-law changes proposed by Dyer. Each is accompanied by a statement of support by Dyer. The utility opposed seven. On the eighth, calling for advance director approval of lobbying expenditures, Union Electric made no recommendation pro or con.

For the New Meter Reader

Toledo Edison Co has created a three-day training program for neophyte meter readers. Among other things, it employs more than 200 slides similar to those used in the army's airplane identification program. It also indoctrinates the men on handling customer complaints, climactic conditions, obstructions, distractions, and dogs.

Quick Change Artists

Mississippi Power Co linemen have put up 109 fluorescent street light fixtures in Gulfport using a special rigging created by Chief Bohn, a substation electrician. Designed to maneuver fixtures into place quickly, the rig consisted of an 18-ft boom extension, timbers, an 18-ft ladder, and block and tackle. It was attached to a line truck's hydraulic derrick. Using "The Thing," as it was called, the men were able to remove old lights and install new ones 25 ft high, averaging 15 min per fixture in some locations.

The Cost of Delay

Delays on the Mountain Sheep and Pleasant Valley projects have increased costs about $20 million, reports A. B. Martin, management coordinator for Pacific Northwest Power Co. Original estimate for the two Snake River projects was about $213 million. Now it's $234 million.

He attributed the increase to steadily mounting construction costs (rising about 3% a year), changes in plans, and the cost of participating in drawn-out hearings before Federal Power Commission.

Fudging on the Meter

Now Connecticut Light & Power Co knows why a Norwalk junior high school's power bill was so much lower than other schools'. Someone jumped the meter on a 100-amp circuit. CL&P figures the school has "free loaded" for about a year. CL&P said a reasonable bill would be figured out. School Sup't Dr Harry Becker said it would be paid. A red-faced contractor confessed to cheating the school's meter when fixing a low-voltage condition about a year ago. The school won't make him write "I will not cheat the meter" one-hundred times, however. The deed was accidental.

Builds 100-Mva Substation in 15 Days

Public Service Co of Indiana rushes temporary bypass when 135-Mva transformer fails and takes Wabash River Station generator off line

By building a temporary 100,000-kva substation in 15 days, Public Service Co of Indiana got a 125-Mw generator at its Wabash River Station back on the line. The substation was used to bypass a failed 135-kva transformer that connected the unit to the system.

The temporary, wood-structure was built, and 12, 13.8/138 kv, 8,333 kva single-phase transformers were installed with bus work and transmission system connections. Transformers and materials were brought from all points on the system and some were purchased.

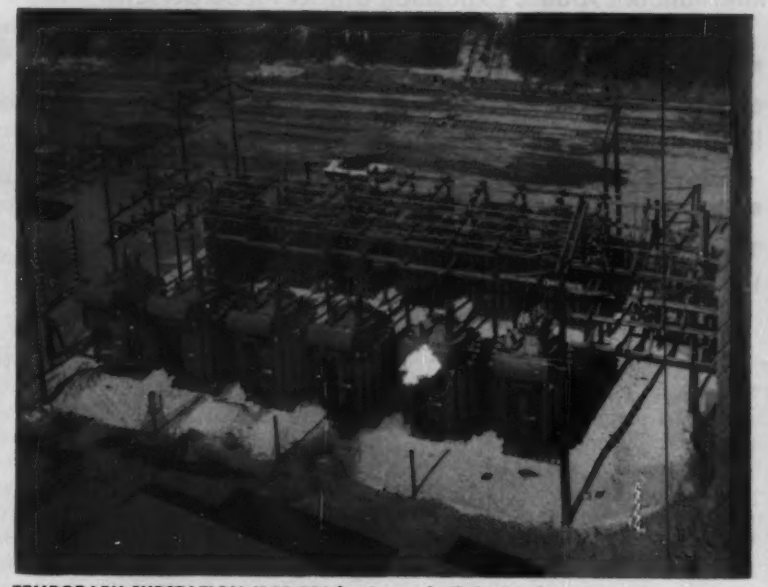
Transformers were connected to form four 3-phase 25,000-kva banks, and the banks were connected in parallel. They were installed in two rows of six each. Spacing between transformers in each row is 14 ft. 6 in. The two parallel rows are 36 ft 6 in. apart. Transformers were set on creosoted timbers.

A temporary bus 40 ft long was built inside the plant. It was made up of 3 in. by ¼-in. copper bars grouped to give the required capacity. The bus was braced to floor, ceiling, and walls to provide the mechanical strength required during periods of system fault. The temporary bus was connected to the permanent generator bus with flexible connections.

Bus Made of Copper Tubes

To bring the bus through the station wall, the porcelain shells of three, 50-kv lightning arresters were used. Flexible connectors were used to make the connections to the temporary substation bus. The temporary substation bus was made up of 2-in. copper tubes.

A short 138-kv transmission line was built to connect the temporary substation to the permanent substation. Equipment and electrical circuit grounding was made to existing ground buses. The station 138-kv transfer oil circuit breaker was used to connect the temporary installation and the 125-Mw generator to the system.



TEMPORARY SUBSTATION (100,000-kva) was built in 15 days to meet emergency when 135,000-kva generator transformer failed at the Wabash River Station

TEMPORARY BUS WORK inside the power station was braced to provide required strength and to assure satisfactory operation during periods of system faults

Atomic Progress Revealed on Triple

- **Second Nuclear Engineering and Science Conference, Fifth Atomic Energy Industry Conference, and Third Annual International Atomic Exposiiton attract 7,000 persons**

- **Program experts reveal determination of scientists and engineers to solve problems of infant industry beset by political, economic, and defense factors**

- **Present atomic energy program called adequate for domestic needs but not adequate to meet the immediate opportunities present in foreign countries**

The progress of nuclear energy to date and likely progress in coming years were spelled out last month at Philadelphia.

The occasion was a triple program which brought together 7,000 persons including practically every "big name" in all branches of the nuclear field. Drawing them either to appear on the program or as spectators were these attractions:

1. The Second Nuclear Engineering and Science Conference sponsored by 26 engineering and scientific societies and coordinated by the Engineers Joint Council.

2. The Fifth Atomic Energy Industry Conference sponsored by the National Industrial Conference Board.

3. The Third Annual International Atomic Exposition which attracted 118 exhibits of equipment and products related to nuclear energy.

Industry Is Determined

The lack of certainty in the infant industry was evident from the lack of unanimity among the speakers. But equally evident was the determination of the experts to solve their problem in a scientific manner yet with a keen awareness of the political, economic, social, and national defense aspects of nuclear power.

At the NICB meeting on March 14-15 industrialists heard that the nuclear energy industry of the United States must get on with the job of developing atomic power not because of any present economic incentives but rather to keep abreast of nuclear technology developments. This was the consensus of a panel of nuclear experts chairmanned by W. K. Davis, Atomic Energy Commission. Beyond this the only other thing the experts agreed on was that they couldn't agree.

Perhaps one of the reasons for lack of unanimity was the apparent lack of a definite national policy in the field. Robert LeBaron, Robert LeBaron Associates, said that national security and politics have taken atomic energy out of the realm of strict engineering consideration. In addressing himself to the panel deliberating "The Latest Prospects for Economic Nuclear Power," LeBaron said the facts can not be evaluated truly until we have a better understanding of government-industry relationship.

Another panel member, M. Fox, Brookhaven National Laboratory, felt that our present program was adequate to cope with our eventual domestic needs in this field but that it was not adequate to meet the immediate opportunities present in foreign countries. Our inadequacies, he said, are due to the fact that we do not have a natural uranium type reactor in our "line". He advised his audience that this is the type of fuel cycle "enrichment poor" nations favor and that because of this England will get as big a share of the foreign market as its industrial capacity will permit.

Although conceding the lucrative opportunities of the present foreign market, J. K. Busby, Pennsylvania P&L Co, felt that we should look the potentials of the

Briefs from the Nuclear Engineering and Science Conference

On Standards . . .

Many of our present standards for electrical equipment will be adequate for nuclear power plants. Big exception will be the insulation requirement for equipment operating within the primary shield—**R. C. Soggo, General Electric**

We have reached the stage of reactor development where it should be possible to set up standard procedures for starting up reactors. Such standards would greatly aid the Reactor Safeguards Committee—**M. A. Schultz, Westinghouse Electric Corp.**

On Radiation Protection . . .

No worker at Oak Ridge has been exposed to radiation in excess of the new permissible code recently announced. This is true even though permissible doses under the old code exceeded the new permissible limits—**K. F. Morgan, Oak Ridge National Laboratory.**

The lower permissible exposure levels dictated by the new code will not hamper the progress of our nuclear industry—**L. S. Taylor, National Bureau of Standards.**

On Future of Boiling Water Reactors . . .

The next logical development would be an increase in pressure until supercritical steam conditions prevail within the reactors—**S. Untermeyer, General Electric Co.**

Program

foreign market straight in the eye. He said we should examine it closely before embarking upon what may become a subsidy of such a market.

Busby offered the following for the consideration of the nuclear industry in this country:

1. The effect of the foreign nuclear market on the dollar shortage in Europe.

2. The natural inclination of industrially developed countries to foster a nuclear industry of their own as a matter of national pride and self-sufficiency.

Euratom Discussed

This latter consideration was pointed out in a speech on the international outlook for atomic energy by P. F. Foster, AEC. In discussing the proposed Euratom plan (EW, Mar. 18, p 61) Foster said:

"It is logical to assume that Euratom will adopt a policy of rapidly building up the technical know-how and the manufacturing capacities of its members so that their imports will be held to a minimum. To acquire the necessary technical know-how and to save time in actually getting into the business of manufacturing power reactors, it will be necessary to develop licensing arrangements with American and British reactor builders. I believe that such licensing arrangements can and will be worked out and that they will be mutually advantageous."

Build Same Type

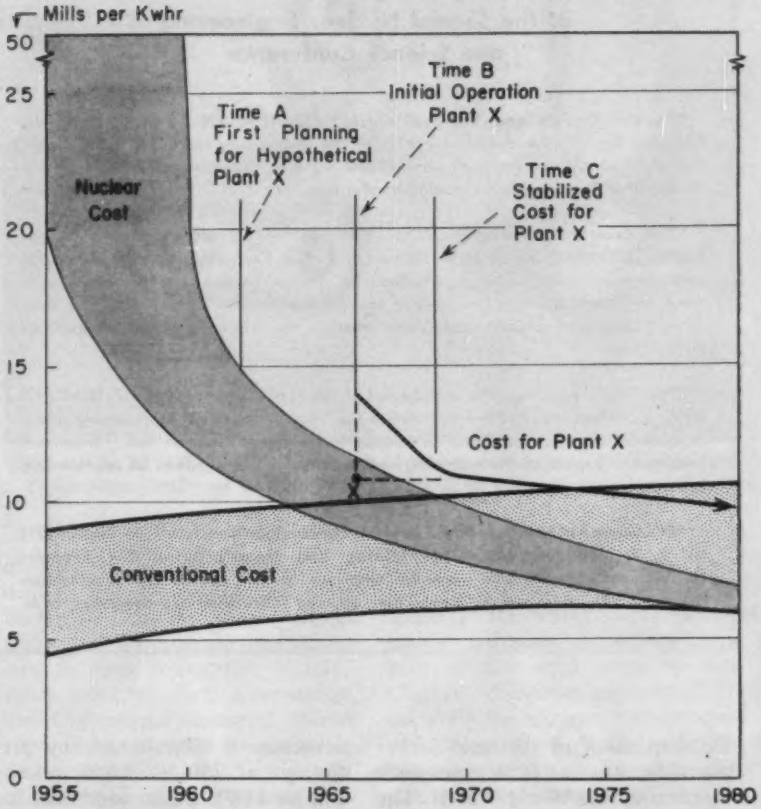
Getting back to domestic affairs, Dr W. H. Zinn, General Nuclear Engineering Corp, suggested that our broad development program of building many different types of reactors may be overlooking the opportunity for gaining knowledge by building a succession of the same type of reactor. Zinn further suggested that this chosen reactor type be built by the same group of engineers who, by living with the type, could produce progress through evolution in their design.

Zinn did not have any particular type reactor in mind but in answer to a question from the floor said the pressurized water reactor would be appropriate. He offered the British program of improving the Calder Hall type as an example of his suggested concentration on one type of reactor. Chairman Davis asked if Zinn would favor operating such reactors before the next version was designed. He replied that this would indeed be ideal but that naturally such a program would have to be modified to meet practical considerations.

While perhaps not disagreeing with Dr Zinn's "same" reactor approach, R. L. Doan, Phillips Petroleum Co, felt that it would be better to have different concerns build the successive generations of this chosen reactor type and thereby get the advantage of competition. He felt that although we have a vigorous atomic program today, private industry cannot provide the necessary capital to promote all necessary phases of the nuclear power industry. Thus there is the problem of harmonizing government "money" and industry "know-how".

As one possible solution Doan made the following suggestion: Build with government funds the reactor portion of nuclear power plants in whatever numbers, types, and sizes appear necessary to the AEC to achieve the desired objectives at locations to be determined by the high bidder for the steam output. The generating portion of the plant would be built with private funds by the interested utilities. The reason for building the reactors would be to gain essential information and experience on selected reactor types, following which the reactors would be disposed of to the highest bidder in a manner similar to that used in

Estimated Cost of Power From Large Nuclear and Conventional Plants Going into Service Each Year
(Assumed Load Factors, 70–80%)



PREDICTED FIGURES presented by W. K. Davis and L. H. Roddis both of the Atomic Energy Commission indicated that A-Power will become competitive around 1965

Other Interesting Papers Presented at the Second Nuclear Engineering and Science Conference

"Reactor Design and the Fuel Cycle" (57-NESC-22) by R. B. Spooner, Koppers Co.—Gives detail examples of the interdependence of reactor design and the fuel cycles. Discusses natural and enriched uranium fuel cycles from the viewpoint of fuel economy, cladding, moderators, flux distribution, etc.

"The Economic Background for Competitive Development of Nuclear Power" (57-NESC-52) by H. W. Nelson and W. R. Keagy, Jr, Battelle Memorial Institute—Examines future expectations for nuclear power after presenting estimates of future demand for electric energy, availability of mineral fuels, their energy costs, and present and future technical developments in the conventional thermal plant.

"The Fuel Cycle from the Standpoint of the Fuel Reprocessor" (57-NESC-42) by C. E. Stevenson, Phillips Petroleum Co—Reviews chemical reprocessing phase of nuclear fuel cycle particular in respect to the overall cost of fuel. Treatment emphasizes impact of the technology rather than an explanation of reprocessing procedures.

"Economics of Ceramic Fuel Elements for Nuclear Reactors" (57-NESC-101) by J. R. Johnson, Minnesota Mining and Manufacturing Co—Analyzes ceramic fuel elements with particular emphasis on their use in high temperature reactor cycles. Discusses efficiency, burn up, and fabrication and processing costs.

the disposition of synthetic rubber plants constructed as an emergency measure during World War II. The high bidder might or might not be the utility owning the generating plant.

Manson Benedict, Massachusetts Institute of Technology, said he favored the present experimental reactor program.

Questions from the audience centered around the heavy water —natural uranium type reactor. The apparent recent popularity of this reactor was questioned. Dr Zinn pointed out, however, that the technology of this combination has been studied for sometime. He also said that the technology of this type is difficult because of the extremely demanding neutron economy. Dr C. Starr, North American Aviation, Inc, (not a panel member) commented that heavy water today costs about $28 per lb whereas it was about $80 per lb a few years ago. Thus the economics of this cycle have definitely changed.

An earlier session predicting future power costs and equipment provided a background for this panel of experts. J. H. Harlow, Philadelphia Electric Co, gave nuclear advocates a difficult task by predicting a 750-Mw conventional unit for 1980. Steam conditions for this would be 7,000 psi 1,400F with three stages of reheat. Coal rate would be 0.6 lb of coal per kwhr. Harlow based his prediction on past equipment and cycle performances and discussions with leading equipment manufacturers. He also said that a combination gas turbine-steam turbine cycle would be used.

M. J. Ankenny, U. S. Bureau of Mines said that there is enough coal of satisfactory quality to meet all demands on it for the next 25 years. He also noted continued increase in efficiency will stretch out the use of coal reserves. K. Mayer, Stanford Research Institute, presented statistics indicating that there will not be much power generated at a cost in excess of 10 mills per kwhr in the United States by 1965. But Europe will still generate a great deal of power for 10 mills per kwhr or greater, according to his figures.

At the Second Nuclear Engineering and Science Conference several papers were devoted to problems of waste disposal. None of them indicated that there has been any "breakthrough" in this very important area of nuclear power plant operation. Nor did any of them hazard more than a guess about cost.

However E. Roedder, U. S. Geological Survey, presented some encouraging experimental results with methods involving pumping of waste through wells into porous and permeable formations (aquifers) situated several thousand ft or deeper in the earth, below the potable water zone. Test results indicate that undesirable chemical reactions between the waste products and the mineralogical composition of the acquifers take place. But it is hoped that exceedingly careful exploration and testing will enable selection of proper aquifers. Chemical treatment of the waste to prevent undesirable reactions before it is injected into the aquifers is also under consideration.

Another possibility, disposal of fission products in glass, was described by R. W. Durham, Atomic Energy of Canada, Ltd. He said the glass product is quite resistant to water leaching. A preliminary cost estimate of the fixation process shows it will add 0.06 mills per kwhr to the cost of nuclear power.

NUCLEAR NOTES

Gas-cooled reactors, according to a Babcock & Wilcox Co study, show promise of yielding greatly improved economics through suspension of graphite dust in the gas and through use of unclad ceramic fuel elements.

Coordination of nuclear activities of all state agencies in development and use of atomic materials has been recommended in a resolution of National Association of Railroad and Utilities Commissioners. Other recommendations: Cooperation of state and federal agencies to eliminate barriers arising through conflicting laws; confirmation of state authority to deal with problems as they arise; and centralization of responsibility in a person or board to achieve proper coordination and cooperation in the public's interest.

Local Selling Stressed at PCEA Meeting

Usage boosts, lighting load, modern kitchen are San Francisco topics

MORE LOCAL EFFORT was keynote theme of Walter J. Maytham, PCEA president, J. R. Hartman, Cincinnati G&E; O. R. Doerr, PG&E, at business development talks

Local promotion must complement the work of the Electrical Industry Coordinating Group, the Business Development Section of the Pacific Coast Electrical Association was told at its annual conference Feb. 28-March 1 at San Francisco. The speaker was J. R. Hartman, vice president, Cincinnati Gas & Electric Co, and chairman of the group.

Sellers are finding their break-even points are rising, warned Walter J. Maytham, vice president, Westinghouse Electric Corp and PCEA president. He stressed sales despite the present prosperity. Only local salesmanship can boost home usage from 3,000 to 25-30,000 kwhr, said O. R. Doerr, vice president, Pacific Gas & Electric Co. People at home, in industry and commerce, and on the farm must be educated about the 400 to 500 beneficial uses of electricity.

Dealer Has Lost to Builder

Walter Lind, PG&E, said that the industry must find out how to create customer desire and how to facilitate selling and installation of residential lighting.

The appliance dealer, often right about kitchen design, has lost his market to the confused builder, said C. L. Neibel, Southern California Edison Co. But the builder, he added, is now seeking help because the complexity of the modern kitchen often means the difference between a sale and loss of investment. Here, he said, is where the smart dealer turned kitchen specialist can make good. Appliance financing remains a problem, said T. L. Cruse, California Electric Power Co, in urging utilities and manufacturers to assist dealers in getting back in the appliance business.

Without personal contact with the customer, there are no closing sales of adequate wiring, whether residential, commercial or industrial, declared Gordon Black, Rome Cable Co. To find out how to appeal to those responsible for electrical work in such construction, the Commercial-Industrial Wiring Committee surveyed the owner-investor group, architects, and electrical consultants.

Architects, the largest group of respondents, welcomed the proposal that the industry provide them with up-to-date information on electrical installations, said U. G. Karrer, PG&E, in reporting the survey.

PCEA is considering a sales information brochure on electric heating and air conditioning equipment to eliminate confusion among architects and contractors, announced K. L. Hampton, PG&E. It will cover the selection and application of resistance space heating, heat pumps, air conditioning, and evaporative coolers.

Prospective heating customers want to know only first and probable annual operating costs of various equipment, declared W. E. Hughes, Southern Nevada Power Co. Technical data confuses them. He expressed hope that specific kwhr per sq ft usage ranges for his own area will be established through submetering of heating loads.

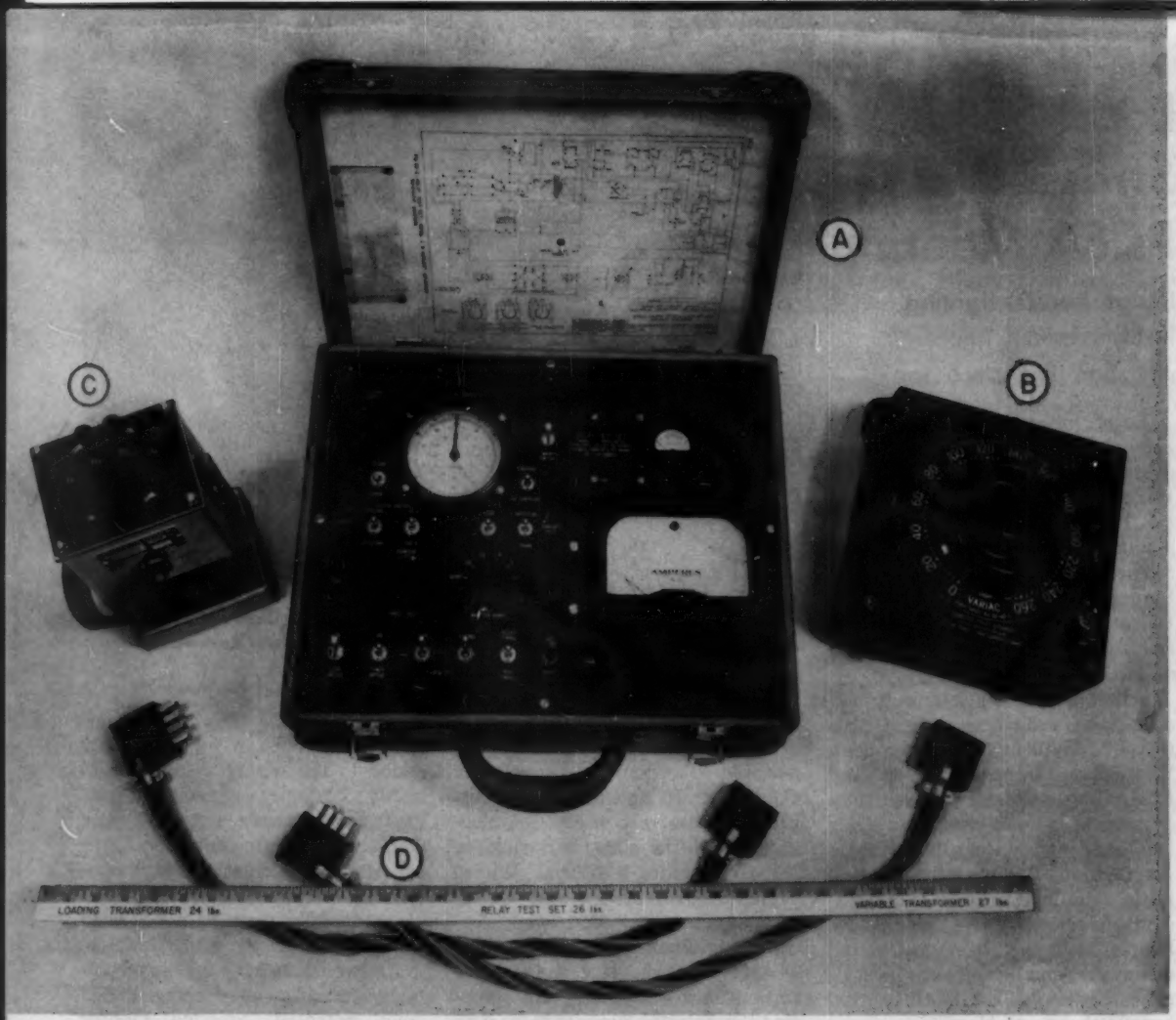
Whether capacitors should be installed at the substation by the company or at the load by the customer was discussed by the Commercial-Industrial Power Committee. Applications in which capacity added to the wiring system would justify customer capacitors near load centers were cited by Ken Oliphant, consulting engineer. Critical need for accurate voltage control in a plant with automatic process equipment, he said, also warrants load-center capacitors.

Electronic cooking for big restaurants and in-plant feeding has a great potential, asserted George Klopp, Hotpoint. Thomas Marshall, York Corp, cited the potential power load of air-source heat pumps using double or compound compression to extract heat from air without added heating elements.

Farm Lighting Good Market

Lighting has still a great potential as a farm load said Van Weisser, General Electric Co, suggesting under-udder floodlighting in the milkhouse, black-light bug lures to indicate the need for spraying, and colored lights for grading produce. Controlled light to stimulate plant growth, he added, probably has the largest load potential.

A well-engineered overhead sprinkler system reduces labor for the farmer, lessens erosion, and increases crop yield, said F. H. Coover, Southern California Edison, pointing out that the serving utility has a larger annual return per installed horsepower from smaller motors running longer.



TVA RELAY TEST SET consists of a control panel (A), a variable-voltage autotransformer (B), a loading transformer (C), and two control cables (D). It incorporates the ideas of Authority's relay testing engineers

TVA Develops Relay Test Set

RELAYING & PROTECTION
Design

All-purpose equipment tests both current and voltage relays, and OCB's as well; is rugged and needs little maintenance

C. R. GOODROE, Electrical Laboratory and Test Branch, Tennessee Valley Authority, Chattanooga, Tenn.

An all-purpose relay test set, developed by the Tennessee Valley Authority, has proved to be rugged and reliable in performing its requirements and needs only minimum maintenance. The set can be changed quickly and easily from testing current relays to testing voltage relays. Its control panel, variable-voltage autotransformer, and loading transformer have plugs and cables for quick, foolproof interconnection, each unit being complete in itself and having terminals for several purposes.

The ideas of all its relay testing engineers were incorporated in the set's simple design to provide all desirable features when TVA found a need for additional test sets. Basically, the set consists of a source of test current and a means of measuring the relay operating time.

The set's control panel, variable-voltage autotransformer, and loading transformer weigh, respectively, 26, 27, and 24 lb. Two control cables complete the unit.

The loading transformer's low-voltage winding supplies the test current which is controlled by the autotransformer. This component varies the voltages applied to the loading transformer input. Thus test currents up to 100 amp are controlled smoothly and continuously. Loading resistors, with their attendant problems of heat dissipation and current drift caused by heating, are completely eliminated.

As current is supplied to the relay under test at a comparatively low voltage and as no power is dissipated in loading resistors, the power

supply requirements are satisfied by a 115-v, 20-amp source.

An ammeter and multi-ratio current transformer, built into the control panel, have ranges of 1, 3, 10, 30, and 100 amp, full scale, The ammeter, a 1-amp instrument, measures current directly on the 1-amp range. On all other ranges the ammeter is fed from the multi-ratio CT. A selector switch permits convenient selection of the suitable range. The multi-range ammeter can be used independently for current measurements of 0-100 amp by connection to the "Ammeter" terminals provided. It has an accuracy of 0.25% on all ranges.

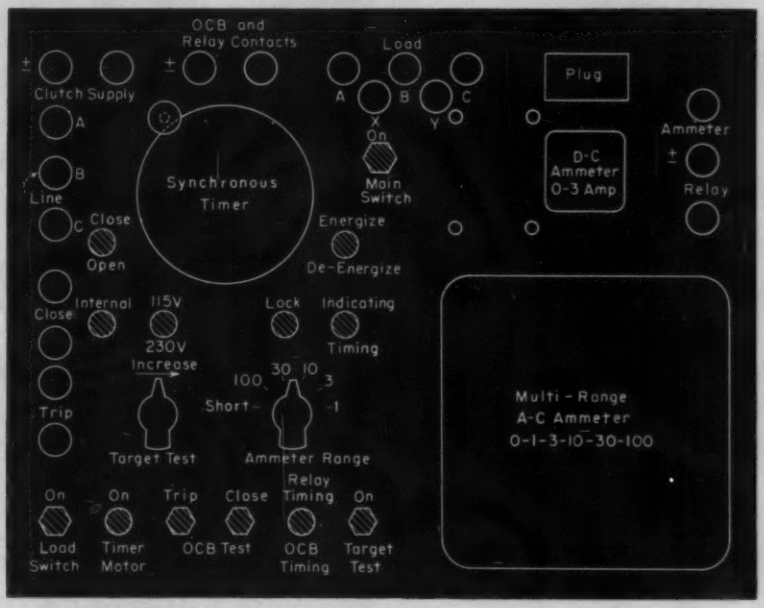
A synchronous timer, also built into the control panel, measures relay operating times. Although its motor requires a 115-v, 60-cps source, the timer clutch-coil and the various other elements in the timing circuits operate on 115 or 230 v ac, or 125 or 250 v dc. An isolating transformer, separating the internal 115-v, 60-cps supply to the timing circuits from the 115-v test supply, prevents tying a station's dc battery circuits and 115-v ac circuits together through the relay test panel.

A "lock" or seal-in circuit can be used during adjustment of the timing relays which close their contacts only momentarily. This circuit stops and holds the timer at the instant of first contact closure.

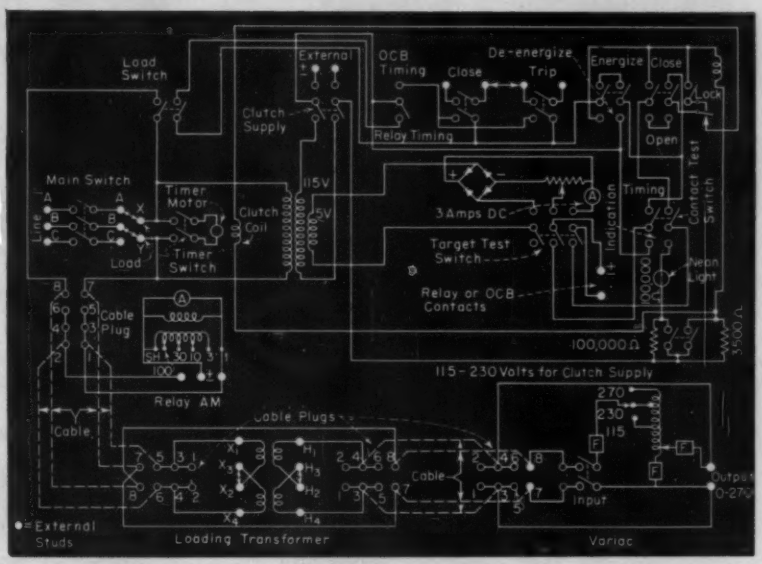
Lamp in Scale

A neon indicating lamp is provided for tests in which an indication, but not the timing, of contact operation is desired. It is situated in the scale of the multi-range ammeter to permit convenient observation of the lamp and ammeter at the same time. A small 0-3 amp dc ammeter, a rectifier, and a potentiometer supply a variable dc current for relay target testing.

Selector switches on the control panel enable quick selection and setting up of the control and timing circuits for the various relay tests. Terminals for connection to power source, relay coil, and contacts are around the outer edge of the panel. For convenient operation the control and selector switches are grouped beside the test engineer's left hand. His right hand is free to operate the variable-voltage autotransformer.



PHYSICAL ARRANGEMENT of the instruments was planned to achieve the maximum convenience and efficiency in conducting tests on relays and breakers



TEST CURRENT is supplied by the loading transformer and controlled by the autotransformer. Power supply requirements are satisfied by a 115-v, 20-amp source

All control and selector switches have simple, functional markings. To measure time from the instant a relay coil is energized until its contacts close, the selector switches are set on "Energize" and "Close." To measure the time from the instant the coil is de-energized until the contacts open, the selector switches are set on "De-energize" and "Open."

Although only single-phase power is required for the test set, a 3-pole "Main Switch" and 3-terminal "Line" and "Load" connections are provided. For distance relay testing, the 3-phase supply to the potential circuits of the additional test equipment can be brought through the control panel and controlled from the "Main Switch."

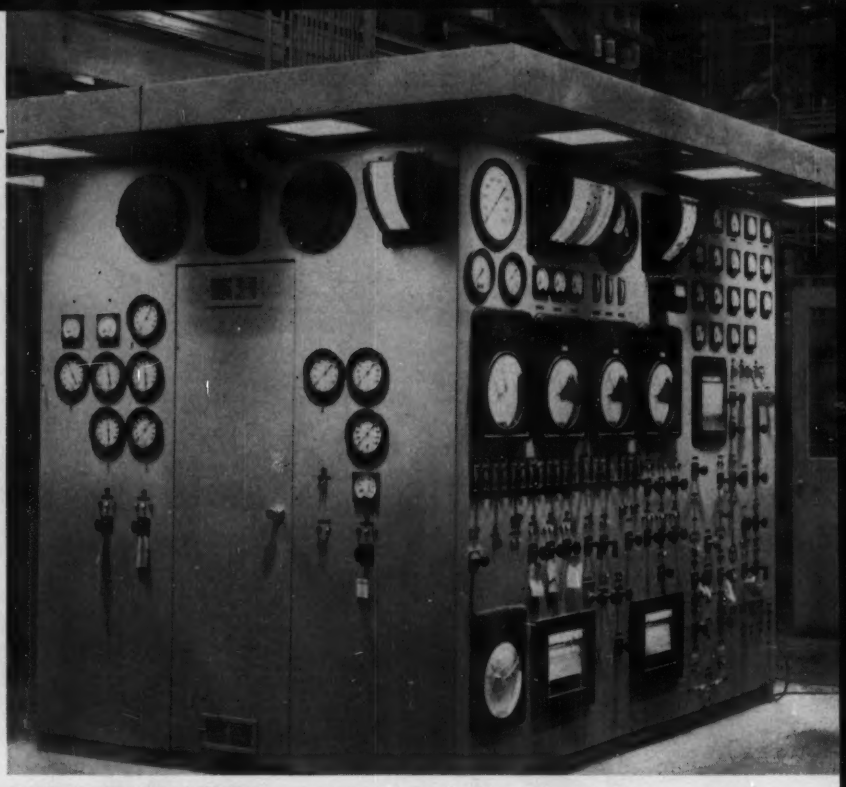
The test set can also control and measure the operating time of circuit breakers.

Designed for Fast Pick-Up

50-Mw Humboldt Bay Plant can go from 5% to nearly full load within 3 seconds

DOUGLAS V. KELLEY, Senior Mechanical Engineer; and

WILLIAM M. PICKSLAY, Supervising Electrical Engineer, Pacific Gas & Electric Co, San Francisco, Calif.



MASTER CONTROL BOARD has instruments for boiler and generator control on boiler side. The other side mounts the turbine controls and the generator relays

Full ability to meet head on either of two operating abnormalities came first in the design of Humboldt Bay steam plant for Pacific Gas & Electric Co. This station, linked with the rest of the system by two 110-kv transmission lines, is required to assume full load promptly should either or both of the ties be lost.

With both lines out, the 50-Mw unit must be capable of picking up from 5% initial load to nearly full load within 3 seconds and continue operating at 100% load. The design is based on doing this twice a year without damage or increased maintainence. This severe requirement arises from the probability of simultaneous outage of both 110-kv circuits. Less severe is the loss of one line when the unit must pick up from 5% initial to 100% load in 2 minutes. It was assumed this less severe condition must be met ten times annually without damage or increased maintenance.

When both lines are lost at time of peak load, it is expected that speed reduction due to quick load pickup will be limited to 10% by automatic load shedding. At the same time, or separately, there may be serious voltage reduction because of transmission faults or equipment malfunction. Thus, essential auxiliary drives may be required to operate satisfactorily for extended periods with speed reductions to 90% and voltage reductions to 65% in any combination.

Humboldt Bay Plant is a vital part of the power resources for the company's Humboldt Division centered about Eureka on the northern California coast. The initial 50-Mw unit will supply the growing load and protect against loss of normal sources. These are mainly transmission lines from the Sacramento Valley. The lines are about 115 miles long, with major portions in heavily forested, rough, mountainous country at elevations up to 5,000 ft. Occasional outages may be expected during the winter storm season. Peak loads in the division are expected to hit 100 Mw in 1957, rising from the 1947 winter peak of about 20 Mw. Local generation in 1947 included the old 14.5-Mw Eureka Station B, supplemented by the 4.8-Mw beached tanker "Donbass." The remainder was supplied over a single 60-kv line from Cottonwood Substation.

Skyrocketing load growth in the division prompted construction of two 110-kv transmission lines from Cottonwood because of the relatively high cost of fuel at Eureka and the time required to construct a steam plant. Each line has a capacity of about 40 Mw. But it became evident in 1953 that a steam plant would soon be required. Because of transmission losses and the larger loads, it would become economic to generate more power in the area in spite of fuel costs. Another factor favoring local generation was the high cost of an accessible transmission route with desirable separation from existing lines.

During much of the time Humboldt Bay Plant will operate at relatively light loads, with the two 110-kv lines supplying lower-incremental-cost power from the company's bulk power transmission system. In the event of an outage on one or both 110-kv circuits, the unit will pick up load as fast as possible.

If both 110-kv lines are lost at peak load, the unit may be subjected to much more than full load with accompanying reduced voltage and frequency. To prevent loss of the unit through loss of auxiliaries, automatic load shedding will switch off outer segments of the area load in steps as dictated by sustained low voltage or reduced frequency. This procedure will

match load with available power and minimize the disturbance in the area, thus permitting the quickest service restoration after the trouble is cleared.

With these operating requirements estabilshed, a number of special features were incorporated in the plant design to make such operation possible. The turbine is a 50-Mw, 3,600-rpm, tandem-compound unit with double-flow exhaust. Moderate throttle steam conditions of 850 psig, 900F were dictated by the estimated relatively low lifetime plant capacity factor. Consideration also was given to the sudden load changes which the turbine must withstand without being damaged. Continuous operation at minimum load with an initial pressure of 1,050 psig was specified.

Special features were added to handle rapid load increases. One is full control-valve travel in 3 sec or less. Certain internal running clearances were increased to minimize the danger of rubbing between rotating and stationary parts during rapid temperature changes. High-pressure cylinder bolting is steam heated to avoid possible damage to the shell flange following sudden temperature changes.

The turbine is designed to take steam as fast as the control valves can be opened. Thus, the ability of the boiler to supply and sustain required steam flow becomes the key to successful quick pickup. To this end several innovations have been incorporated.

No Economizer for Boiler

The boiler is a two-drum type with a radiant furnace but with over 20,000 sq ft of convection boiler surface. It has no economizer. Nominal steam capacity is 475,000 lb/hr with a constant 900F steam temperature guaranteed over a 20 to 100% load range.

Beginning with and immediately following a quick load pickup, heat required to produce steam must come from that stored in the boiler setting and boiler water. This "heat reservoir" maintains operation until the firing rate can be increased to balance heat input to the water with heat being withdrawn in the steam. Generation of steam by flashing of water in the boiler is accompanied by a reduction in steam pressure. If not compensated for, this pressure drop would cause a corresponding reduction in turbine capability.

To give the boiler a "head start" during quick pickup, the plant is designed to operate at 1,050 psig at minimum load. This is 200 psi above normal turbine inlet pressure. The excess pressure is an economical means of obtaining stored heat for use during the time required to increase the firing rate to its maximum value, 120% of steady-state full-load fuel rate.

Large Steam Drum is Used

Before the maximum fuel rate can be reached, fan dampers and the fuel valve must be opened, the mass of combustion air and flue gas must be accelerated, and air flow and fuel flow must be kept in step. Based on the time required for these actions, it was considered impractical to attempt to reach full firing rate in less than 12 seconds. Important auxiliaries, such as draft fans and feed pumps, are designed for constant-speed operation to eliminate time delay for accelerating rotating equipment.

To prevent moisture carry-over to the turbine during a sudden load increase, the steam separating drum (72-in. ID) is larger than normally required. The larger drum serves as a heat reservoir, provides necessary space for the steam separating equipment, and minimizes drum "swell." Drum-water level will be carried as low as feasible at minimum loads. It is expected the level will remain within the gage-glass range at all times during quick pickup.

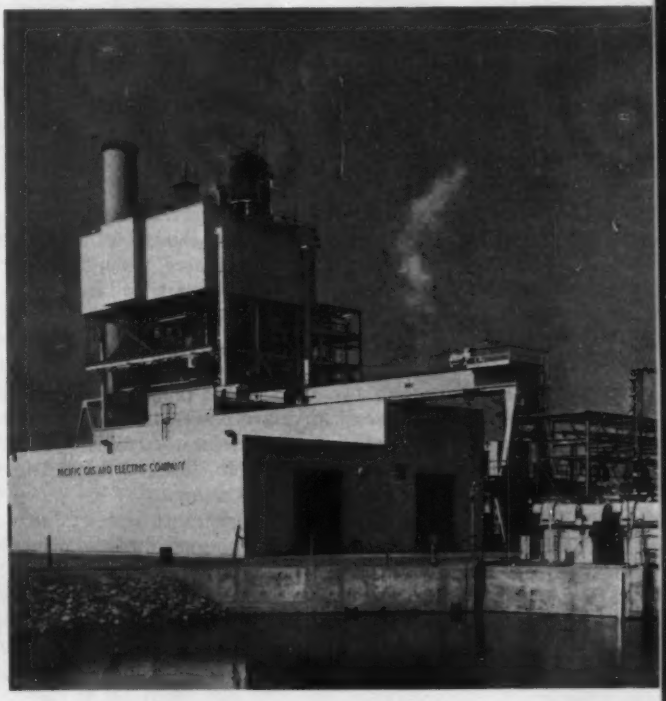
Maintenance of full steam temperature is guaranteed down to 20% rated boiler load. In anticipation of extended periods of operation at loads less than 20%, steam temperature will be maintained by increasing gas mass flow through the superheater. For this purpose a duct connection runs from the forced-draft fan discharge to near the bottom of the rear furnace wall. Through this duct excess air added to the furnace will bypass the burner registers. Thus, large amounts of excess air may be added at low loads without danger of blowing out the fires.

Significant among the steam auxiliaries is the turbine drive on one of the two full-size boiler feed pumps. Using the turbine-driven pump materially increases the net generating capability of the plant at full load. Exhaust steam from the feed-pump turbine goes to the deaerating heater to maintain the heater pressure above atmospheric, even at low loads.

Essentially all instruments and controls for plant operation are mounted on a tunnel-type master control board. This board is located between the boiler front and the head end of the turbine. Boiler and generator controls are located on the boiler side, turbine controls on the turbine side, and miscellaneous recorders and controls on the ends.

Because of long and relatively weak associated transmissions circuits, area load power factor is normally corrected by switched and unswitched capacitors.

About 0.95 pf is held at the input to substation trans-



formers stepping down to distribution circuits. This power factor correction, together with transmission line charging currents, necessitates leading power factor operation for night and weekend loads. However, with an outage of one 110-kv transmission circuit from Cottonwood, the other circuit becomes heavily loaded. Then the generator may be required to operate as low as 0.8 pf lagging to supply vars to maintain voltage at the load.

May Operate As Condenser

Operation of the unit as a condenser will not be a normal requirement although the turbine coupling is arranged so the generator may be disconnected in emergencies. It will then be started by bringing it up to speed with a unit at Station B, or after 1958 with another unit at Humboldt Bay.

To minimize hydrogen leakage, the unit normally will operate at 12-15 psig. During quick pick-up of load the pressure will increase automatically to 30 psig in response to machine kw loading. Hydrogen supply racks will have three bottles more than required for a unit of this size.

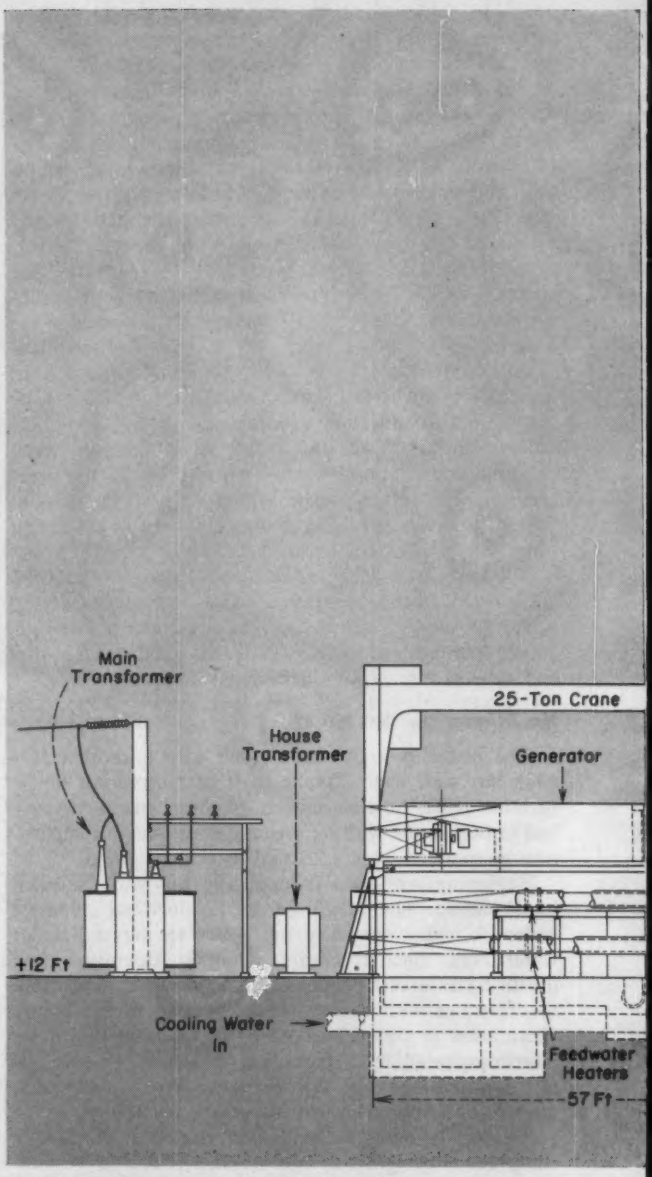
The geared exciter is rated 180 kw, 250 v, and 897 rpm. A geared exciter was selected to meet, expected long periods of light-load operation. The slower-speed exciter driven by the main turbine will have less commutation difficulties and should be otherwise more reliable than a motor-driven unit. This is important because the spare exciter will be omitted unless need develops for it. This provided a major saving of $50,000, in part due to the 90% frequency and/or 65% voltage requirements which would be imposed on the spare exciter motor.

Aside from lower speed, the only special requirements for the exciter were an ASA speed of response of not less than 1.5 and a minimum ceiling voltage of 140% of rating when loaded by a fixed resistance. The first takes full advantage of the modern high-speed, magnetic-amplifier regulator with adjustable minimum excitation limit provided. The second assures continued high-speed performance and full-generator excitation at the reduced exciter speeds expected under double-line outage conditions.

Auxiliaries at 2,400 and 480 V

Auxiliary power is taken at the generator terminals through a 3,750-kva, OA, 3-phase house transformer bank. For start-up and alternate source, a similar bank steps down from the 60-kv transmission voltage. Both banks provide 2.4-kv auxiliary power to the motor-driven boiler-feed pump and the forced and induced-draft fans. Remainder of the auxiliaries are supplied at 480 v through two 500-kva, 3-phase, load-center transformers. Normal auxiliary power source is house bank No. 1 (supplied from generator terminals) with automatic throwover to bank No. 2 after the 2.4-kv bus voltage has fallen to 25% of normal.

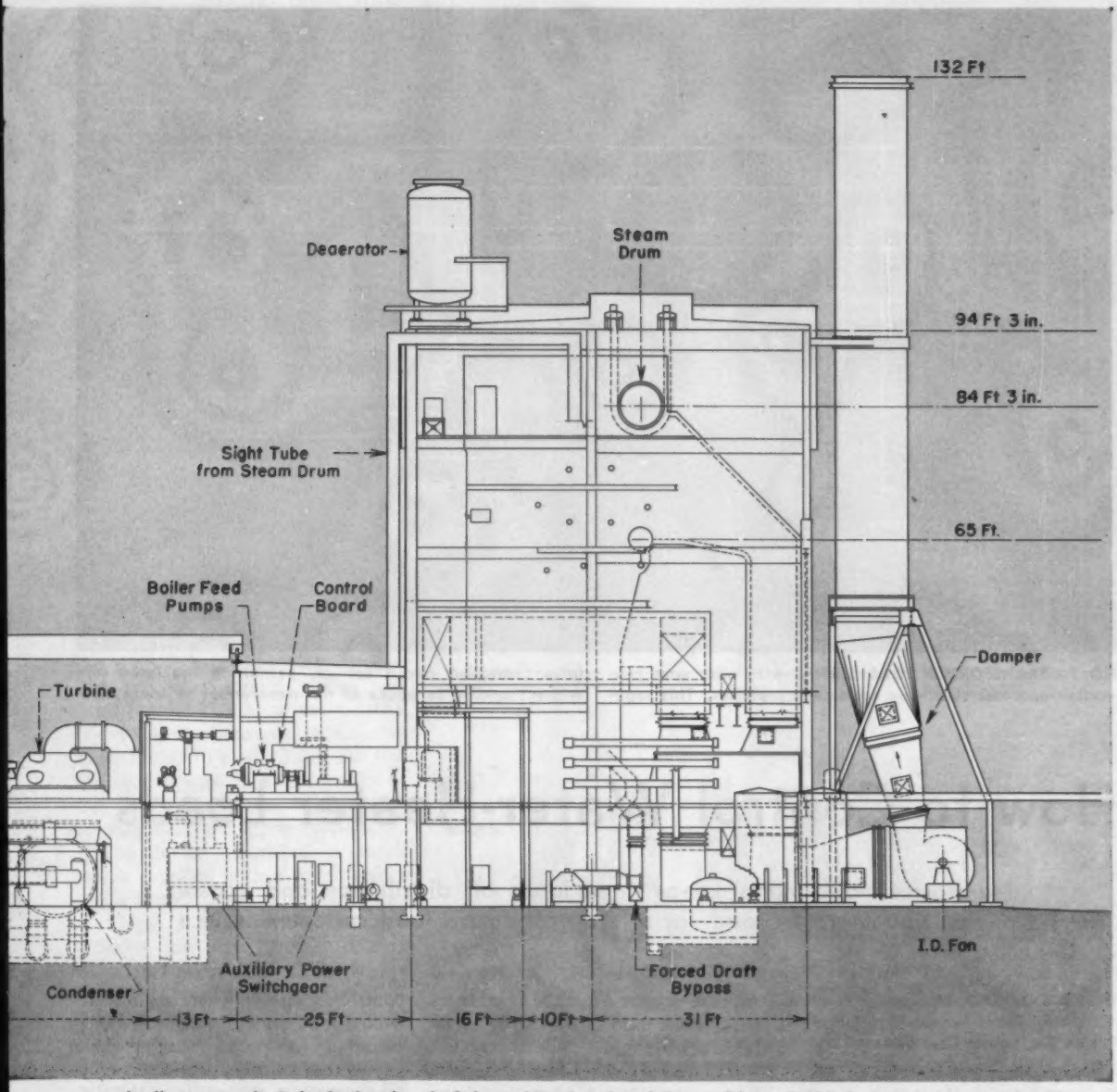
All essential auxiliary motors must operate continuously and satisfy torque requirements of the driven device with 10% reduction in frequency and 35% in voltage in any combination. Essential auxiliaries are those whose failure to operate will either reduce turbine output or cause a unit shutdown. Non-essential auxiliaries are required only to operate with torque output sufficient for the driven device with voltage reduced to 65% for one minute without bad effects.



SIDE ELEVATION OF HUMBOLDT BAY PLANT reveals arrangement of equipment. The semi-outdoor boiler is protected by

The plant is situated on a point of land which extends into Humboldt Bay. Circulating water is taken from one side and discharged into the other, thereby eliminating any recirculation. However, this location exposes the plant to salt fog in addition to normal weather extremes. To reduce insulator washing, the 60-kv switchyard apparatus bushings have a minimum creepage distance of 48.5 in. compared with the previous standard of 41 in. for 69-kv class bushings. Creepage distance on 60-kv main and auxiliary buses which are less accessible was increased to 81 in.

Two 60-kv circuits to the plant were provided by



an umbrella-type roof. Only the head end of the turbine is enclosed. By designing the station to burn oil, the designers found it possible to build the steam generator and operating floor closer to the ground, thus reducing plant costs

looping-in the existing Newburg Jct-Newburg 60-kv wood pole line. A third circuit to Humboldt Substation is provided by the initial circuit on a new double-circuit 110-kv steel tower line. These three circuits will provide capacity for full output of the unit wth an outage of any one of them.

When the second unit is added, the steel tower line will have the second circuit added. It will be converted to 110-kv operation for the third unit. To replace the 60-kv circuit so lost, another 60-kv wood pole transmission circuit will be built to Newburg Jct substation.

The 60-kv circuits are equipped with automatic reclosing control. Switching for maintenance or repairs will be done by Eureka area troublemen. This reduces the electrical transmission duties of the plant operators to controlling the unit load in response to telephoned instructions from Humboldt Substation—the area switching and control center—over a microwave link. Thus only three steam plant operators per shift are needed.

Reduction of switching duties also permitted location of the control room equipment in the firing aisle rather than separately, as has been past practice. The 60-kv switchyard control board is located in the firing aisle, also. But, it will be moved to a separate control room in the switchyard at least by the time the plant reaches its designed four-unit capacity.

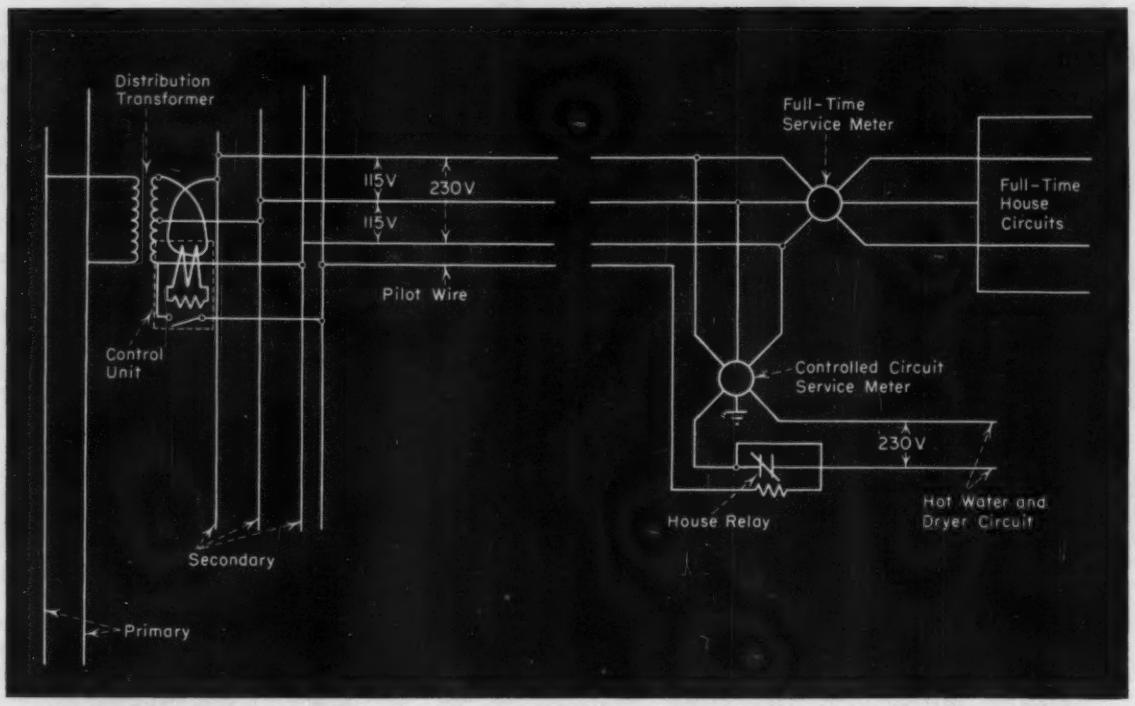


FIG 1—TRANSFORMER LOAD SIGNAL with pilot wire connection operates switch on customer's premises. This regulates controlled circuit service, permitting maximum use without adding to peaks of the transformer or the system

How to Control Water-Heater Loads

Transformer load signal keeps these loads off distribution and system peaks, yet improves load factor, rate of return, and customer service

GLENN S. YOUNG, Manager of Power & Lighting Sales, Kansas City Power & Light Co, Kansas City, Mo.

An economical method of keeping water-heater loads off the distribution and the system peaks, yet providing customers with all the hot water needed, has proved successful on trial installation on the Kansas City Power & Light Co system. The device should make possible improved load factor and rate of return for utilities and better service for their customers. It also opens the way to serving other appliances on an interruptible basis.

Much study has gone into the problem of improving system load factors, and the sharp increase in air-conditioning loads has emphasized the need for developing valley loads. One way of doing this is by offering rate inducements for interruptible service for those appliances that can be used satisfactorily on an interruptible basis.

Controlled water-heater service is an example of what has been done in the past. But water-heater service has been handicapped by what frequently proved to be extended "off" periods that deprived the customer of hot water.

Service "Off" at Peak Only

The author tackled the problem on the basis of having the service "off" only when the peak load actually occurs—not for the usual extended period that is sure to cover the time of peak load.

Months of research and testing under laboratory conditions produced a rather simple and comparatively economical method of circuit control. It is based on opening the controlled circuit when the uncontrolled load on the transformer approaches its peak. Studies have shown that this occurs almost simultaneously with the peaks of the distribution circuit and the system.

The control unit that does this job is a load-sensing device installed at the transformer. It controls the home's circuit through a pilot wire system and relay in the home (Fig 1). The control unit at the transformer is sensitive to ambient temperatures and therefore during cold weather permits the transformer to carry heavier loads before operating the control circuit.

As the transformer load reaches the setting on the control unit, the load-sensing device signals the relay in the home to open the switch on the controlled circuit. The controlled circuit could supply not only

water-heater load but other loads that would be interruptible for short times during peak load.

Because the control is operated by a transformer load signal, the device takes advantage of coincident demands of customers and is not dependent on the load characteristics of the individual customer. The control unit is self adjusting for the load on the transformer and for subsequent increases in the uncontrolled load. One control unit will control the deferrable loads in all residences served from a single transformer.

The control unit could be installed at any point on the system. However it appears that the transformer secondary leads will afford the most economical installation that will give fully satisfactory results.

62-Day Field Test

After thorough laboratory tests the new control unit was given a 62-day field test during the peak of the 1956 air-conditioning season. The controlled circuit service was available 1,435.3 hr of these 1,488 hr—96.46% of the total period covering the 1956 peak (Table I). But the service was off at the peaks of the transformer, the distribution system, and the company system.

The device controlled a circuit which supplied both a water heater and a clothes dryer. The heater was a 52-gal NEMA-rated unit with 1,500-w top and 1,000-w bottom elements interlocked. The clothes dryer was rated 4,500 w. The load-sensing device permitted the controlled circuit to remain in service until the transformer load reached a pre-set value, with allowances for ambient temperature.

Eight Homes on Test Circuit

Figs 2 and 3 show the actual load curves for the 37½-kva distribution transformer which served eight residential customers on the test circuit. The charts illustrate continuous seven-day periods during the summer and winter peaks. Average power usage of these eight homes was 5,951 kwhr for the year ending Sept. 22, 1956.

Summer peak of this transformer was 19.2 kw in 1955. But maximum uncontrolled load on the transformer during the 62-day trial period rose to 21.6 kw (Fig 4). The

Table I—Availability of Controlled Circuit Service

(July 16-Sept. 15, 1956)

Date	Service Off, Hr	Max Temp, Deg F	Date	Service Off, Hr	Max Temp, Deg F	Date	Service Off, Hr	Max Temp Deg F
July 16	2:44	92	Aug. 6	0:45	91	Aug. 27	....	93
17	0:53	88	7	1:10	91	28	....	95
18	....	85	8	2:23	100	29	....	88
19	....	89	9	....	87	30	....	91
20	....	81	10	....	81	31	....	78
21	....	84	11	....	83	Sept. 1	....	86
22	....	88	12	....	97	2	....	96
23	....	92	13	1:05	90	3	....	95
24	....	90	14	2:06	96	4	....	93
25	0:38	92	15	1:00	99	5	....	87
26	1:30	102	16	6:59	102	6	....	68
27	1:35	101	17	6:46	101	7	....	71
28	1:30	98	18	3:44	89	8	....	78
29	....	88	19	....	69	9	....	84
30	4:08	97	20	....	74	10	....	96
31	5:25	100	21	....	80	11	....	100
Aug. 1	1:34	94	22	....	95	12	0:14	102
2	....	93	23	....	97	13	4:33	98
3	....	99	24	....	85	14	....	83
4	0:40	103	25	....	93	15	....	88
5	1:17	97	26	....	97			

Total Time Off = 52:39 hr **Availability = 96.46%**

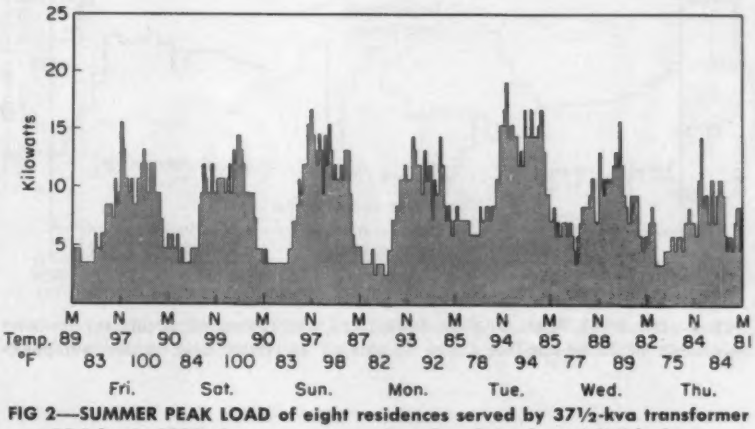


FIG 2—SUMMER PEAK LOAD of eight residences served by 37½-kva transformer was 19.2 kw in 1955. Average consumption of each is about 6,000 kwhr a year

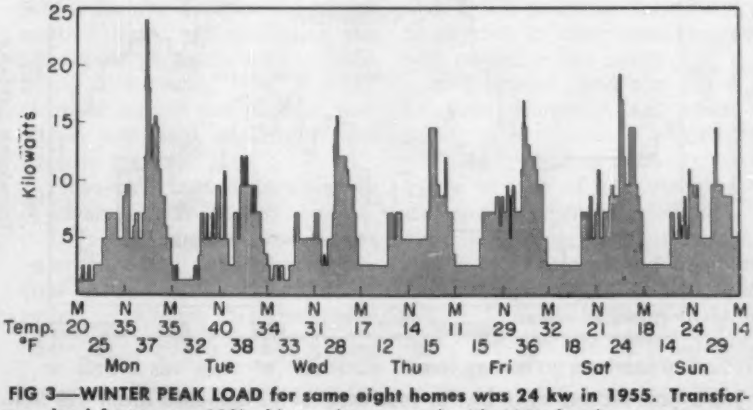


FIG 3—WINTER PEAK LOAD for same eight homes was 24 kw in 1955. Transformer load factor was 32% this week compared with 43% for the summer peak

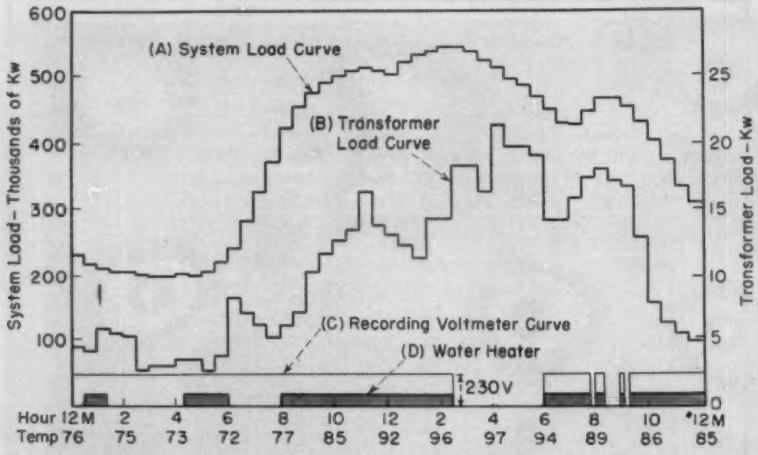

(A) System Load Curve
(B) Transformer Load Curve
(C) Recording Voltmeter Curve
(D) Water Heater
230V
System Load - Thousands of Kw
Transformer Load - Kw
Hour 12M 2 4 6 8 10 12 2 4 6 8 10 12M
Temp 76 75 73 72 77 85 92 96 97 94 89 86 85

FIG 4—MAXIMUM FIRM LOAD on transformer rose to 21.6 kw in 1956 summer. The control was set to disconnect at 15 kw in 100F ambient, or 70% of firm load

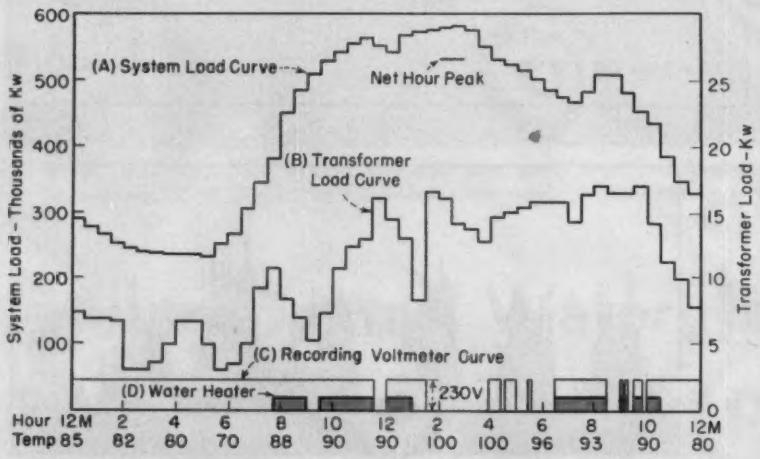

(A) System Load Curve
Net Hour Peak
(B) Transformer Load Curve
(C) Recording Voltmeter Curve
(D) Water Heater
230V
System Load - Thousands of Kw
Transformer Load - Kw
Hour 12M 2 4 6 8 10 12 2 4 6 8 10 12M
Temp 85 82 80 70 88 90 90 100 100 96 93 90 80

FIG 5—ON FIRST PEAK DAY of 1956 (July 31) controlled circuit service was available 18:35 hr but (see Curve C) was off at system and transformer peaks

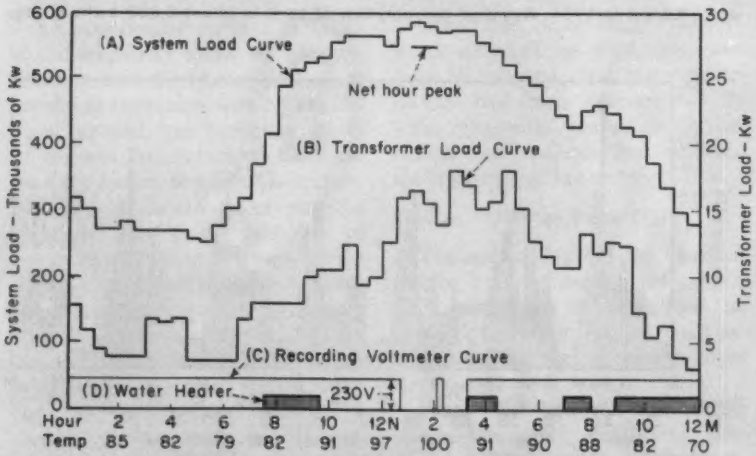

(A) System Load Curve
Net hour peak
(B) Transformer Load Curve
(C) Recording Voltmeter Curve
(D) Water Heater
230V
System Load - Thousands of Kw
Transformer Load - Kw
Hour 2 4 6 8 10 12N 2 4 6 8 10 12M
Temp 85 82 79 82 91 97 100 91 90 88 82 70

FIG 6—ON SECOND PEAK DAY of 1956 (Aug. 8) the controlled circuit was interrupted at system and distribution peaks but permitted 21:37 hr of service

control unit was set to turn off the controlled circuit when the transformer load reached 15 kw or about 70% of the maximum uncontrolled load in an ambient temperature of 100F. The control unit was intentionally set low to reflect the low saturation, 12½%, of the controlled load.

Voltmeter Times Interruptions

Effectiveness of the control unit on July 31, 1956, the first day the system peak exceeded the 1955 peak, is illustrated in Fig. 5. Curve A is the system gross load based on 30-min intervals, and Curve B the 30-min interval transformer loading recorded on a demand meter. Curve C, a voltage curve recorded across the controlled circuit, permits accurate timing by showing zero voltage when the circuit was interrupted. Curve D gives the water-heater use recorded by a demand meter. The dryer circuit was controlled but not submetered.

The system load curve (A) shows that the one-hr net peak was reached between 2 and 3 PM. The voltmeter curve (C) proves that the controlled circuit was interrupted during this peak as well as during the transformer peak. The controlled circuit service was available 18:35 hr on July 31 when the temperature soared to 100F.

The control unit proved its worth again on Aug. 8 when the previous system peak was exceeded (Fig 6). Again the controlled circuit was interrupted during both the system and the distribution peaks. The controlled circuit service was available 21:37 hr on this peak day.

Ambient Sensitivity Proved

Laboratory experiments had indicated that the control unit was sensitive to ambient temperature as well as to load. It can be seen in Fig 6 that the controlled circuit remained disconnected from 2:30 to 3 PM when the load on the transformer was 18 kw in an ambient temperature of 100F. Yet a load of 18 kw was permitted between 4:30 and 5 PM after the temperature had dropped to 91F.

This drop in temperature was caused by a mild wind and rainstorm shortly after 3 PM. Sensitivity of the control unit to ambient temperature indicates that it will adjust automatically to the increased

capability of a distribution system at lower ambient temperatures.

On Aug. 17, when the highest system peak to date occurred, the controlled circuit was interrupted during both the net hour system peak and the transformer peak (Fig 7). On this day the controlled circuit service was off for 5:40 hr—the maximum continuous off-service time during the field trial.

24-Hr Service Possible

A typical daily load curve under moderate temperatures requiring no air conditioning (Fig 8) shows that controlled circuit service was available all 24 hr. The controlled circuit service has been available 24 hr per day since Sept. 13, 1956. A review of the transformer load charts covering the 1955-56 fall, winter, and spring seasons indicates 24-hr availability of the controlled circuit service until summer 1957.

The control unit used in the field trial is actuated by heat developed in a heating element by the current in the secondary circuit of a current transformer. A heat-expandable liquid acting on a bellows assembly moves a push rod which actuates the switch contacts. The setting of the field trial unit is made by a manual adjusting screw which raises and lowers the switch assembly.

Self-Adjusting Feature

A self-adjusting feature (Fig 9) has been developed since installation of the trial unit. This feature permits installation on new transformers, transformers in the utilities' stock or transformers in service. It should keep field adjustments to a minimum. This is how this new feature works:

The push rod, moving upward by heat developed by both controlled and uncontrolled loads, actuates the switch and disconnects the controlled load. The rod continues its travel and moves the switch carriage to a position in relation to the peak established by the uncontrolled load. The switch carriage is latched in this position until a greater uncontrolled load peak causes the push rod to move it to a higher position. A decrease in the uncontrolled load from the peak results in cooling of the expandable liquid and retraction of the push rod. This opens the switch and restores service to the controlled load.

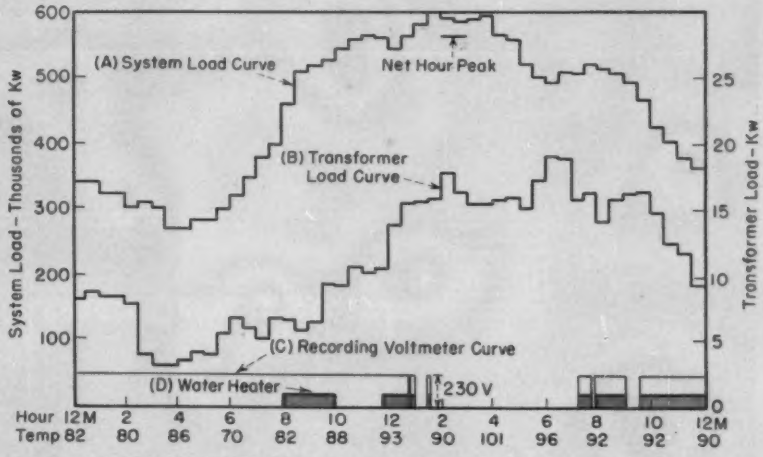

(A) System Load Curve
Net Hour Peak
(B) Transformer Load Curve
(C) Recording Voltmeter Curve
(D) Water Heater
230 V
System Load - Thousands of Kw
Transformer Load - Kw
Hour 12M 2 4 6 8 10 12 2 4 6 8 10 12M
Temp 82 80 86 70 82 88 93 90 101 96 92 92 90

FIG 7—ON HIGHEST SYSTEM PEAK to date (Aug. 17) the device permitted 17:14 hr of service and recorded the maximum continuous off-service time of 5:40 hr

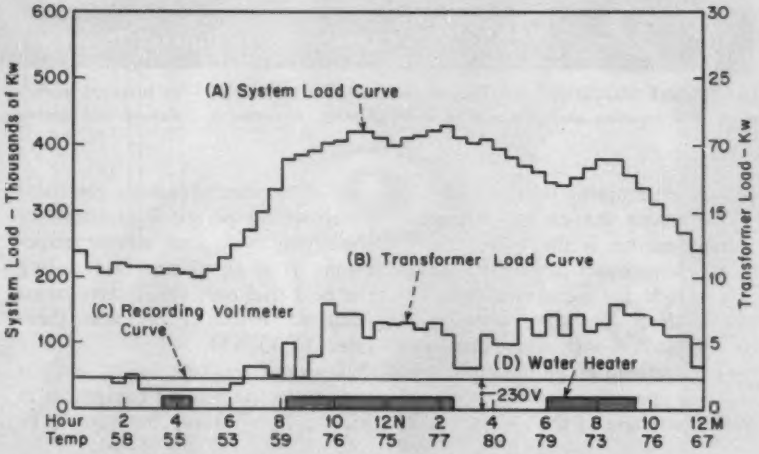

(A) System Load Curve
(B) Transformer Load Curve
(C) Recording Voltmeter Curve
(D) Water Heater
230V
System Load - Thousands of Kw
Transformer Load - Kw
Hour 2 4 6 8 10 12N 2 4 6 8 10 12M
Temp 58 55 53 59 76 75 77 80 79 73 76 67

FIG 8—UNDER MODERATE TEMPERATURES requiring no air conditioning the controlled circuit is on duty 24 hr. This 24-hr. use is expected until 1957 summer

Further developments in the unit are anticipated, particularly with regard to making it self-contained and weather tight, and perfecting the self-adjusting mechanism. Additional field testing over a wider range of service and climatic conditions will help standardize and improve the unit.

This type of control has a number of advantages. Some are:

1. It will minimize load surges on reconnecting the controlled circuits because of the inherent staggering of loading between transformers on a feeder circuit.

2. It can be built to set itself automatically to a percentage of the uncontrolled load growth on the transformer, thus requiring minimum attention.

3. It will permit an electric utility to improve its competitive position with respect to fuel energy.

4. It should provide a stimulus for sales promotion and selective selling.

5. By controlling loads not critical as to time of use, transformer change-outs might be deferred.

6. By appropriate relay installation in the controlled circuits in the home, an automatic reduction in voltage from 230 to 115 v could be used. This would curtail energy input to heating equipment to 25% of the maximum wattage on one or more circuits, at the same time com-

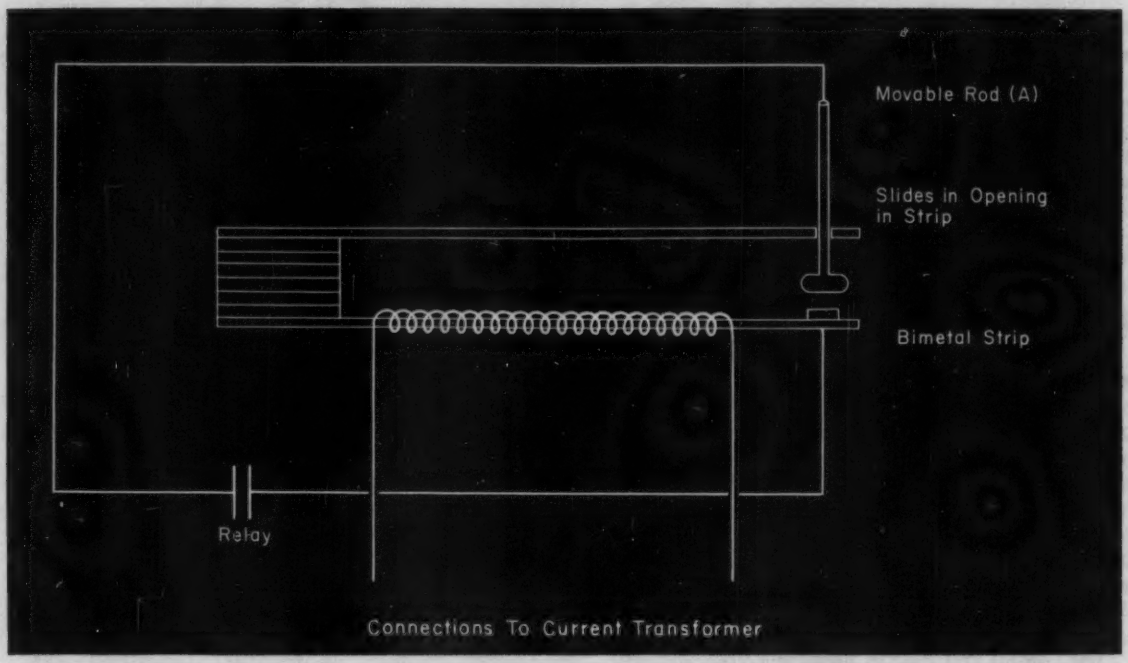


FIG 9—SELF ADJUSTING FEATURE of control is set by flow of current in heating element around bimetal strip. Movement of bimetal pushes movable rod "A" to new position that determines operation of relays during next peak load period

pletely interrupting other circuits.

The major year-round kwhr-consuming market is the water heater. Other year-round market possibilities include the incinerator and the clothes dryer. The latter would need to be handled with some care and perhaps offered on an optional basis if lower operating cost was a factor in the purchase of the appliance. In case of an interruption an electrical timer would permit completion of the drying cycle after service restoration. It is significant that during the field trial only two interruptions occurred before noon and these after 11:30 AM.

Seasonal markets might include use of electric heating equipment in hard-to-heat rooms, bathrooms, or game rooms in existing homes. Likewise, rooms added to existing homes offer a sizable electric heating market. Supplemental heat for the heat pump on a storage basis would be another possible market.

Valley kwhr can produce an attractive percentage return for the utility and equally attractive low-cost energy for customers (Table II). Fixed charges on the increasingly expensive distribution system needed to serve the rapidly growing residential load can be eliminated from the cost of valley energy. Moreover, fixed costs on generating capacity can be eliminated or reduced, depending on the system peak responsibility of the home load.

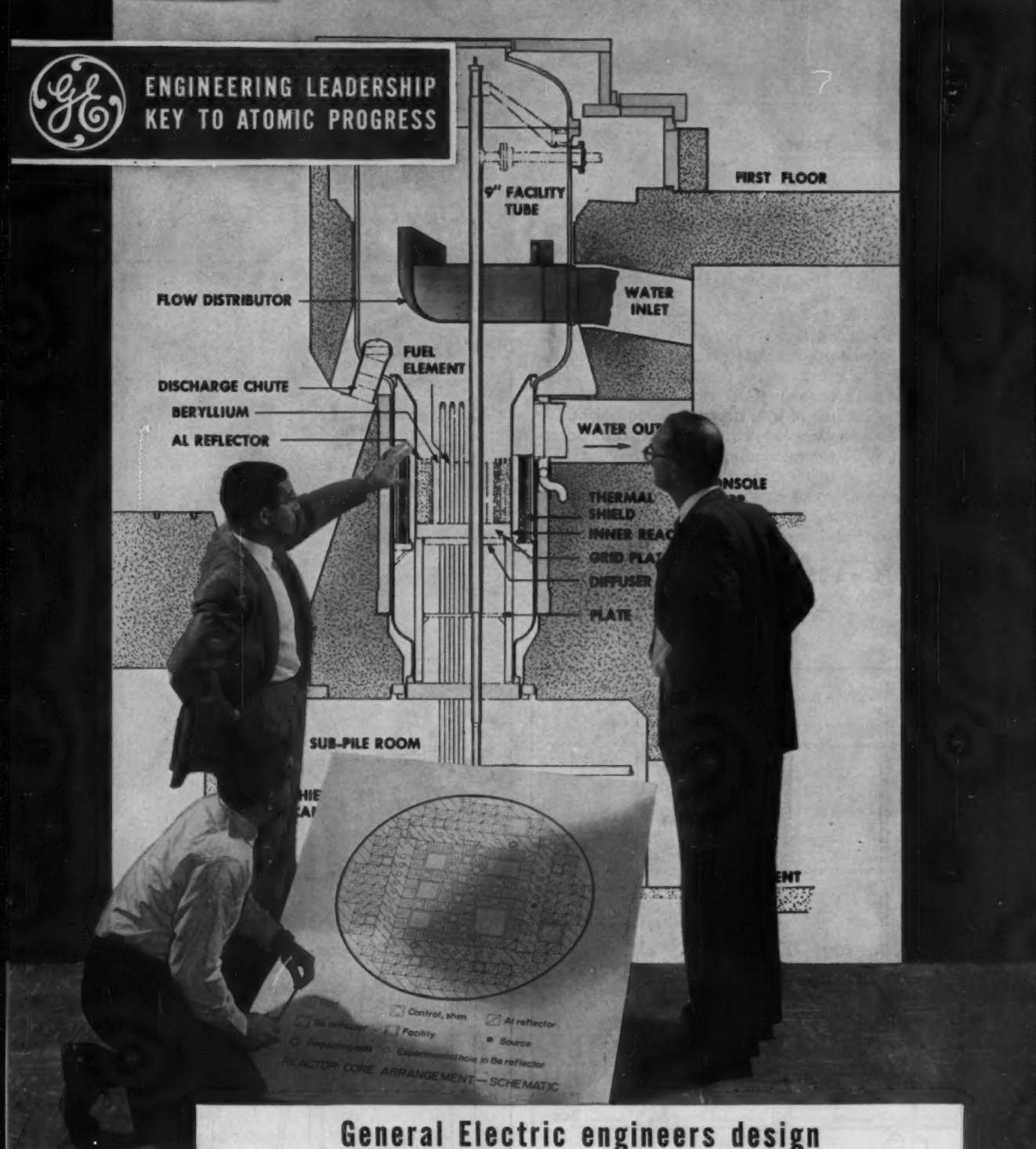
The specific cost of the control unit is not yet available. However preliminary information indicates that its installed cost plus that of the pilot wire (which conceivably could be fabricated in the service drop) and the cost of the house relay will produce an adequate return on one water heater customer per transformer—yet, the control unit controls all of the deferrable loads served from the transformer.

Patent coverage includes U. S. Patent 2,771,558 for the principles involved, with additional U. S. and foreign patents pending.

Table II—Incremental Return from Controlled Circuit

Estimated total incremental investment	$135.00	
Operating revenue, 15,000 kwhr at 1.0¢		$150.00
Production cost, 15,000 kwhr at 0.3¢	$45.00	
Operating and maintenance, 2.5% × $135	3.38	
Fixed charges		
Depreciation, 2.85% × $135	3.85	
General taxes, 9.00% × $150	13.50	
Bond interest, 4% × $135 × 50%	2.70	68.43
Assumed taxable net income		$81.57
Federal income tax at 52%		42.42
		$39.15
Preferred dividend, 4.5% × $135 × 15%		.91
Available for common		$38.24
Percent of operating revenue		25.5%

Based on three customers, each using 5,000 kwhr per year of valley energy, served from the same transformer with one control unit



General Electric engineers design 175,000-kw Engineering Test Reactor

A test reactor with extremely high flux, coupled with in-core testing facilities, presents heat transfer, physics and mechanical problems of a new magnitude. In designing the Engineering Test Reactor, General Electric engineers provided solutions to these difficult problems.

This reactor was designed by General Electric for Kaiser Engineers, prime contractor to the AEC, and will be placed in operation at the National Reactor Testing Station, Idaho.

The accomplishment of this design is another example of General Electric engineering leadership in the field of atomic energy. Atomic Power Equipment Department, General Electric Company, San Jose, California. 1964-4

Progress Is Our Most Important Product

GENERAL ELECTRIC

TODAY'S DESIGN TRENDS

HV Disconnect Saves Switchyard Space

A. TURGEON, Chief Designer, Eastern Power Devices, Ltd., Toronto, Ont.

A vertical-insulator disconnecting switch with a new blade arrangement saves switchyard space by eliminating one insulator stack and permitting direct contact with the strain bus. The device extends to higher voltages the space savings hitherto restricted to 138 kv and below, because of insulator and switch weight.

The disconnecting switch has fewer components, and a study of several station layouts showed a 15 to 43% saving in switchyard space.

The advantages of a vertically disposed disconnect switch for linking a lower apparatus or bus with a higher bus has been generally recognized. But at 138 kv the total cantilever rating of the higher voltage stack includes a 35% weight component for the stack alone. With the addition of switch parts, the total

(Continued on page 70)

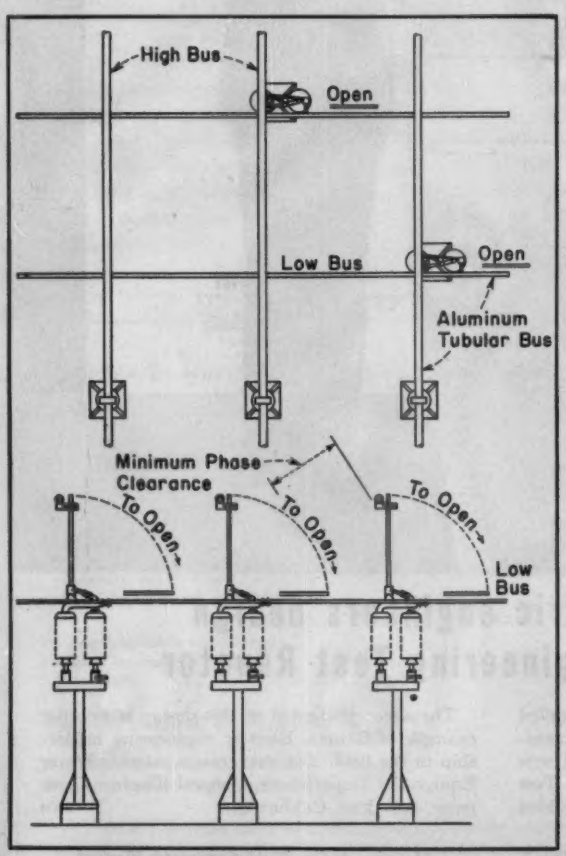


FIG 1—ELIMINATION of the insulator stack supporting the switch jaw contact is wholly practicable in this design

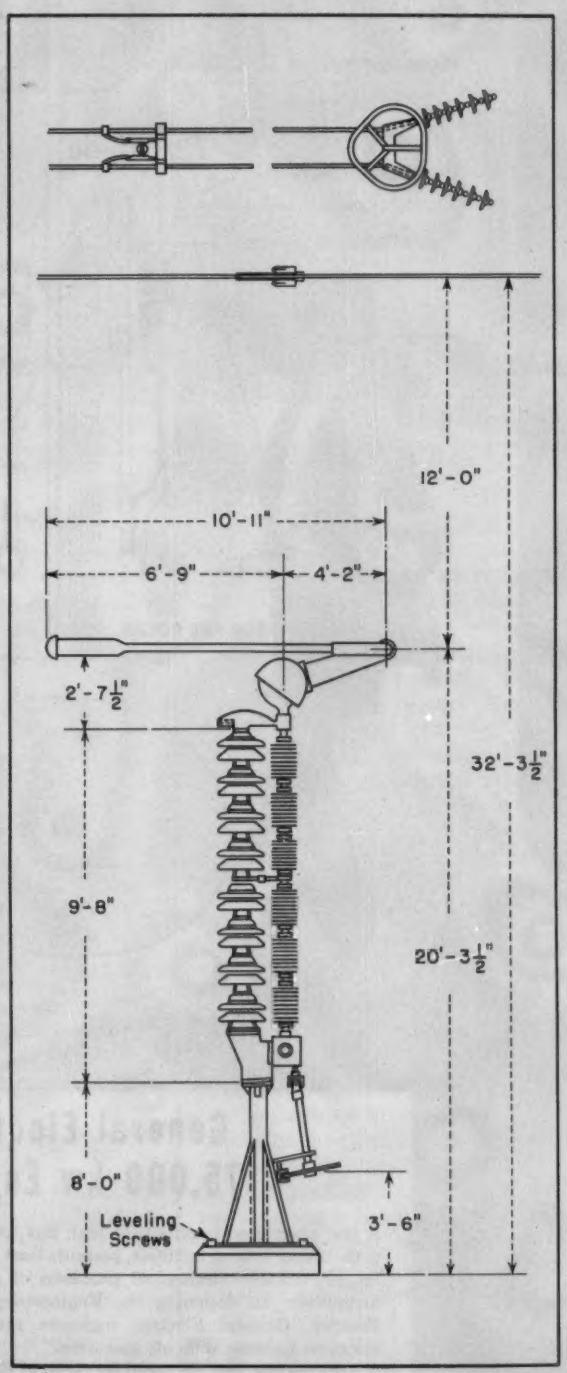
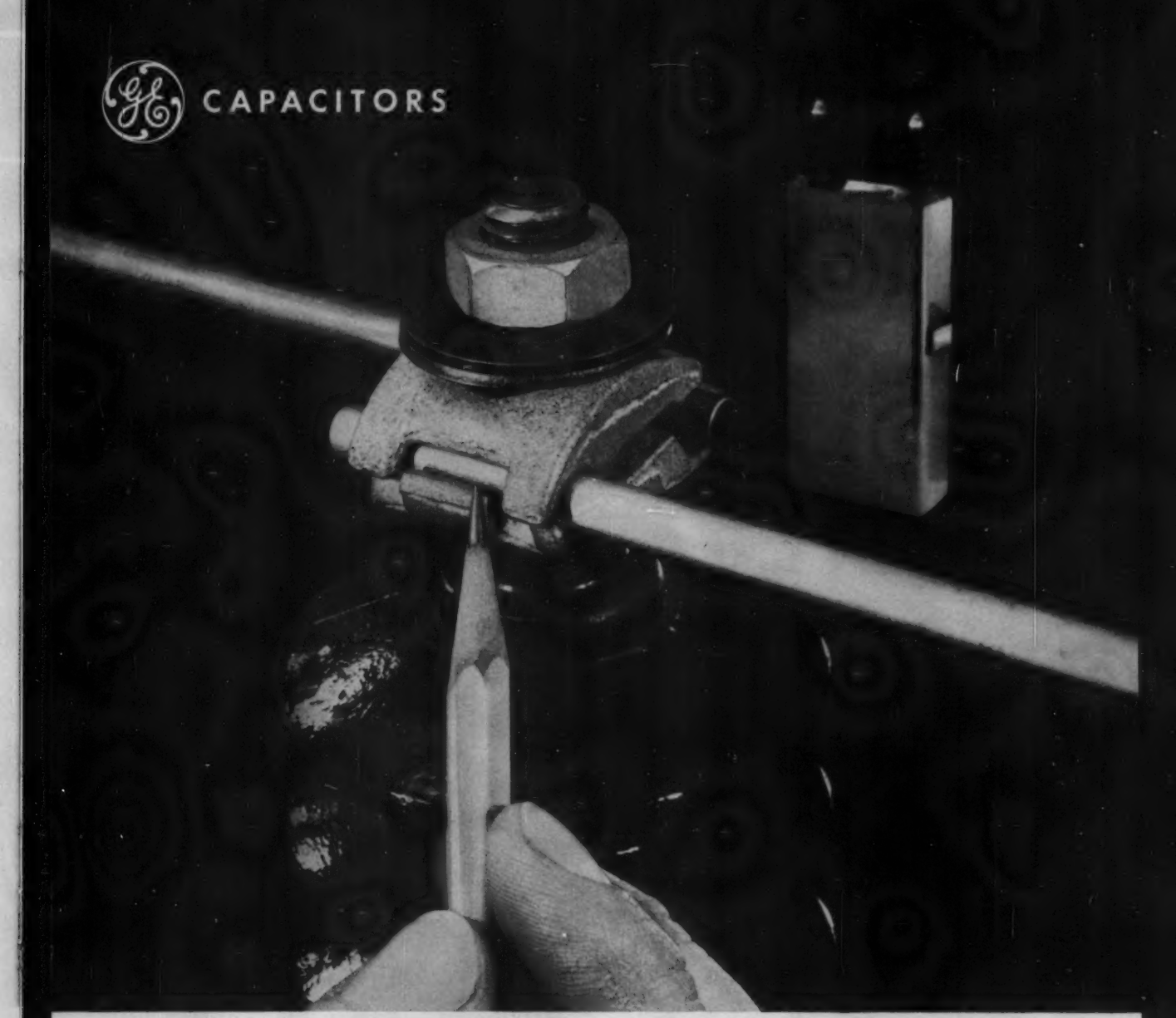


FIG 2—VERTICAL INSULATOR DISCONNECT contacts strain bus supported from 30-deg offset with compensating springs



Cold flow gets big squeeze

A capacitor terminal can't stop the cold flow of aluminum conductors, but it can adjust to it. The "big squeeze" provided by General Electric's terminal assembly does just that. Here's what happens.

No matter how the conductor shrinks, expands, or "flows," the jaws of the connector* bear down with a continuous quarter-ton grip. Cone-disk Belleville washers provide this firm, flexible, follow-up pressure that maintains full area contact and helps to keep out corrosion.

The result? No hot joints from corrosion or poor contact, even on switched capacitor banks with frequent thermal cycling. The big squeeze on cold flow is another Engineered Extra you get only with G-E capacitors.

Any questions? Your G-E Apparatus Sales Engineer can probably answer them. Or write to General Electric, Section 445–1, Schenectady 5, New York.

*General Electric's jumbo, parallel-groove connector, ideal for Al or Cu.

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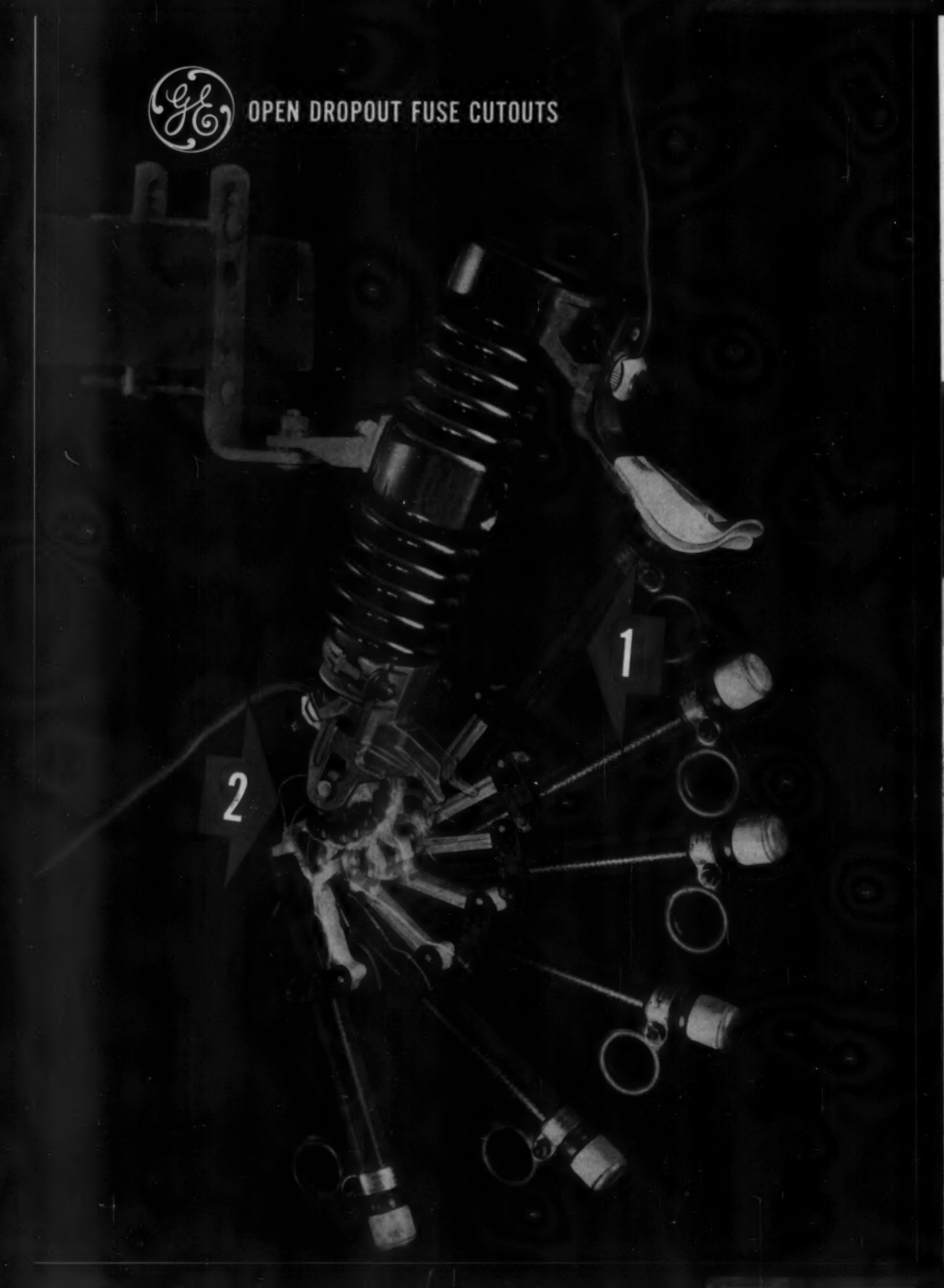
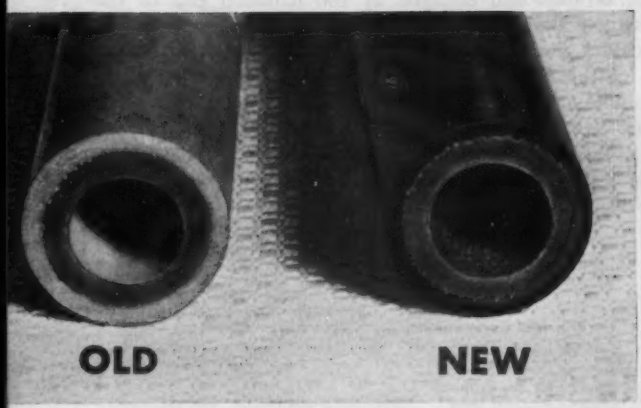
OPEN DROPOUT FUSE CUTOUTS

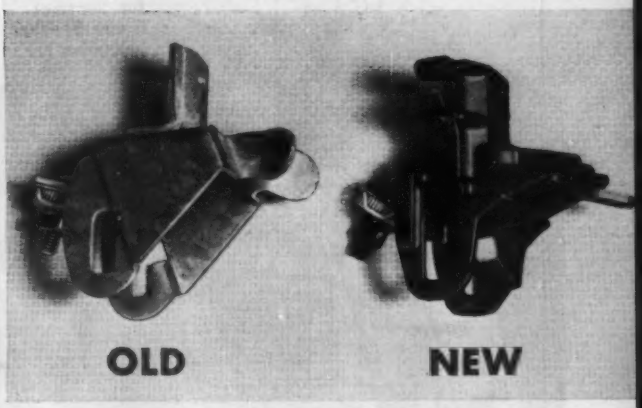


Now—even longer service life from General Electric Open Dropout Fuse Cutouts with

New Polyester Fuse Tube... New Bronze Fittings...



1 **COMPARISON OF OLD AND NEW FUSE TUBES** shows increased thickness of fiber is made possible by a new, thinner but tougher sheath of fiberglass reinforced plastics. More fiber lengthens tube life by allowing greater number of cutout operations with increased reliability.



2 **NEW CORROSION-RESISTANT BRONZE HINGE** (right) has dependable characteristics of old-type galvanized hinge, plus positive operation after years of service in corrosive atmospheres. Fuse-holder drops immediately when fuse blows, slams back easily after re-fusing.

General Electric's new Open Fuse Cutout gives you these important changes that assure even better performance, longer service life and mean fewer problems for linemen.

New fuse tube now features a tough outer protective sheath of reinforced polyester resin. It is practically immune from the effects of weather and age. Improved characteristics and greater strength of this new material permit a thinner sheath, allowing greater thickness of fiber to be used in the fuse tube. As a result, ***these new tubes stand up longer under repeated operations.***

New lower hinge of improved design, together with all component parts, is now made entirely of bronze, virtually ending corrosion problems encountered with galvanized fittings. Hinge won't stick—operates freely after years of exposure even in salt air and other corrosive atmospheres.

Other features include new hanger support construction, compression-clamped fittings, permanent high-pressure contact and latch, long lasting silver-plated contacts, complete bird-proof construction, optional load-break device and disconnect blade.

Heavy-duty ratings include a 15-kv, 100-ampere cutout with an interrupting rating of 4000 amperes and a 7.8-kv, 100-ampere unit with a 5000-ampere interrupting rating.

For complete information, contact your nearest G-E Sales Representative, or write to General Electric Company, Section 433-20, Schenectady 5, New York.

LIVE BETTER ELECTRICALLY

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GENERAL ELECTRIC

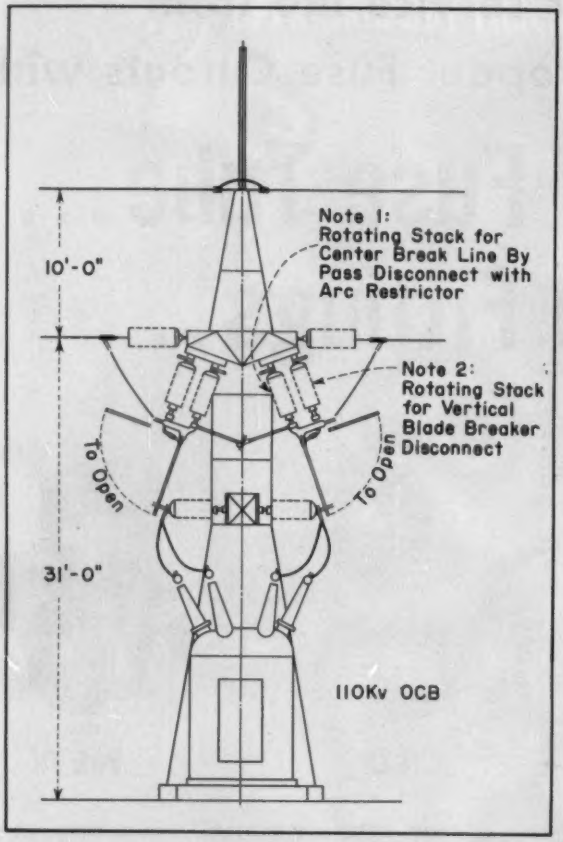


FIG. 3—TWO FUNCTIONS may be performed by the same switch. It can serve both as a line bypass and breaker disconnect. The space savings and other advantages of this redesigned switch are tabulated in the box to the right

loading and resultant deflection become unacceptable.

The obvious solution is a switch blade mechanism operating with vertically disposed insulators to obtain the desired advantages without too much increase in cantilever loadings. The new switch does these.

The insulator stack supporting the switch jaw has been eliminated by using the higher bus as a support in connecting low and high buses. The single switch serves as a line bypass and breaker disconnect. As an EHV disconnecting switch, the design provides for folding the blade when in the open position. This permits more compact arrangements in the switchyard.

Substitution of strain for rigid buses also affords savings. A jaw, consisting of two parallel current-carrying, spring-backed members, is mounted on the strain bus and engaged by the flattened end of the switch blade contact. A jaw suspended between the cables gives greater stability.

Strain insulators with a 30-deg offset are much more stable against rotation than co-linear disposition. Space is saved by rotation of the switch blade mechanism into a horizontal plane when collapsed. It assumes this position by following a simple cam track.

Switchyard Redesign Saves Space

Principal Components	New and Conventional Switches	Conventional Switches only
Switches (new)	10	0
Switches (conventional)	2	12
Columns for Bus Supports	55	69
Stacking Insulator Units	805	1,239
Strain Insulators for Dual Buses Supporting Switch Jaws	1,584	0
Strain Insulators for Strain Buses only	945	1,323
Trusses, 66 Ft	25	25
Switchyard Area, Sq Ft	73,416	113,460

GENERATION—Maintenance

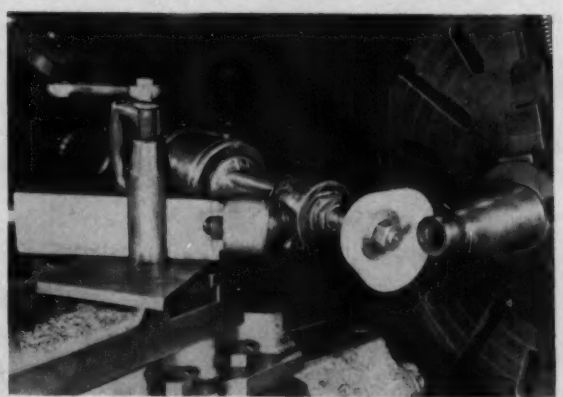
Swivel Holder Makes Grinding Operations Easier

GEORGE SPANGLER, Harding Street Plant Superintendent
Indianapolis Power & Light Co, Indianapolis, Ind.

Finish grinding operations have been improved at Indianapolis Power & Light Co's Harding Street plant by a new swivel holder for a tool post grinder. The assembly consists of a ball-socket joint, a tool holder, and a single locking stem which locks the ball through the ball sleeve.

The holder can be used on any piece of machine shop equipment that is in motion. It is easily mounted for use in finish grinding of turbine water gland seals after machining or metalizing and for grinding turbine blade tips after reblading. Other uses of the swivel holder are being explored.

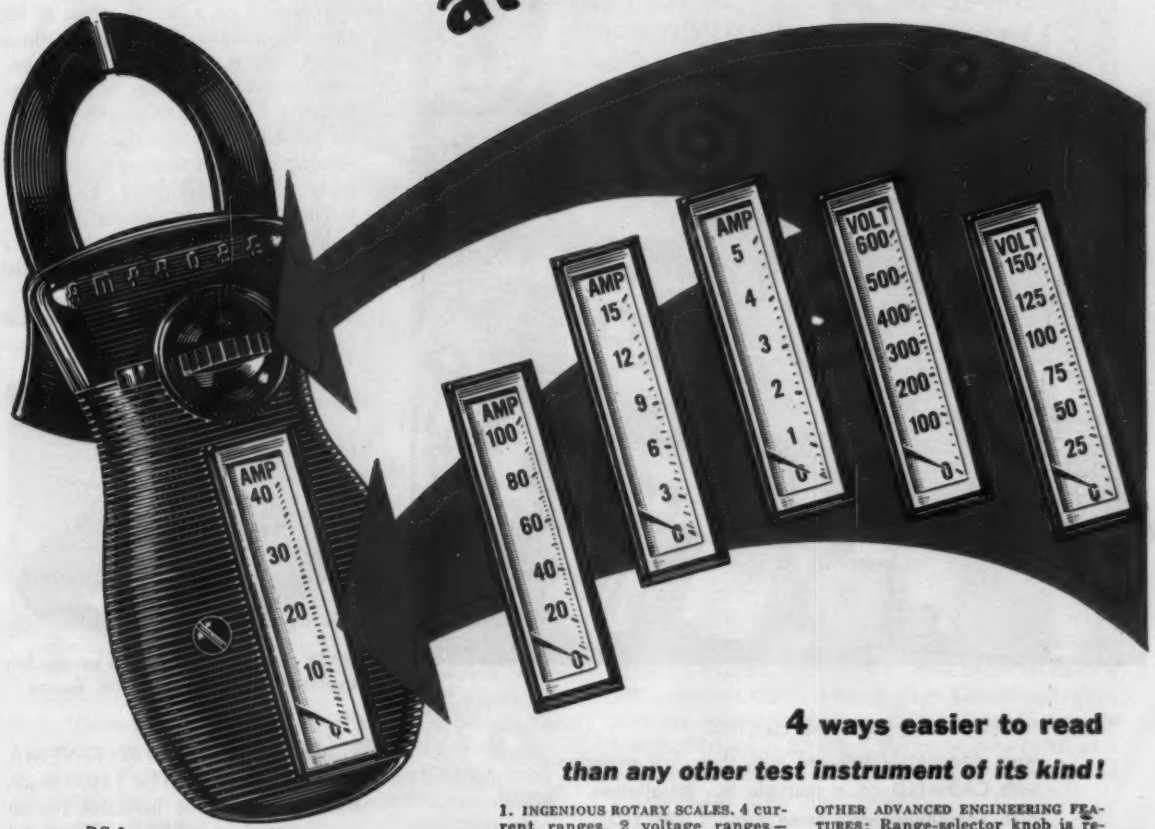
(More How To on page 72)



SWIVEL HOLDER simplifies finish grinding of turbine water gland seals, turbine blade tips, and other operations

NEW ADVANCED DESIGN ROTARY RANGE AMPROBE® RS-1

see only one scale at a time!



RS-1

$39.85

There's one for every job and every budget.

The new RS-1 is one of the 14 AMPROBE® models priced from $19.85 to $67.50.

4 ways easier to read

than any other test instrument of its kind!

1. INGENIOUS ROTARY SCALES. 4 current ranges, 2 voltage ranges—each on a scale of its own!

2. ONE HAND OPERATION! Range selector knob is next to your thumb.

3. NEW MAGNIFIED DIAL . . . LONGER SCALE LENGTH. Greater visibility, greater accuracy, than ever before.

4. POINTER-LOCK "FREEZES" POINTER AT READING. Use the RS-1 any place your hand can reach. Needle can be locked in place so that you may read it away from conductor.

OTHER ADVANCED ENGINEERING FEATURES: Range-selector knob is recessed so that it can't be moved accidentally. Simple bayonet leads lock in at bottom for quick connecting. Impact-proof case with non-slip ribbing. Advance printed circuit construction. Shielded core magnetic movement. Leather carrying case can be worn on your belt.

Amprobe, a division of Pyramid Instrument Corp., Lynbrook, New York, manufacturers of famous REMCON simplified low-voltage Hi-Fashion switching devices.

don't guess at it; AMPROBE® IT!

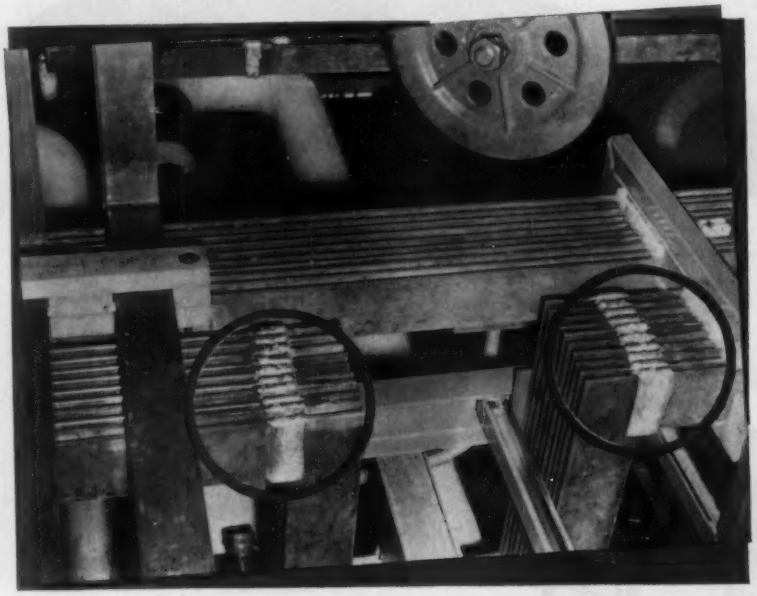
GENERAL ELECTRIC

endorses Contractor's use of

CADWELD®

electrical bus bar connections

HATFIELD ELECTRIC CO., INC., nationally-known electrical contractor recently completed an electrical bus bar installation for the GENERAL ELECTRIC COMPANY at Louisville, Kentucky. CADWELD ELECTRICAL CONNECTIONS were used on the ½ x 3 and ¼ x 4 bus bars that feed the GENERAL ELECTRIC plating tanks.



HATFIELD and GENERAL ELECTRIC were completely satisfied with their first experience with CADWELD on a multiple bus installation. Both companies have been using CADWELD for grounding connections for over five years.

Before figuring your next bus installation, investigate **CADWELD.**

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

Radio-Noise Source Aids in HV Studies

R. D. BROWN, Electronic and Communications Section, Hydro-Electric Power Commission of Ontario, Toronto, Canada

The noise-producing suspension insulator may be used to determine the radio frequency radiating characteristics of high-voltage transmission lines. It can be used also to measure line attenuation and the effect of line filters.

Installed on a line in place of an existing insulator, it will produce an intense source of white noise. One desirable feature is that the frequency spectrum of the generator noise extends into the TV bands, although corona does not. Accordingly, investigations of TV interference may be carried out also.

In a recent test the insulator was used to relate laboratory and field noise measurements at 1 Mc. The noise level of the insulator was first

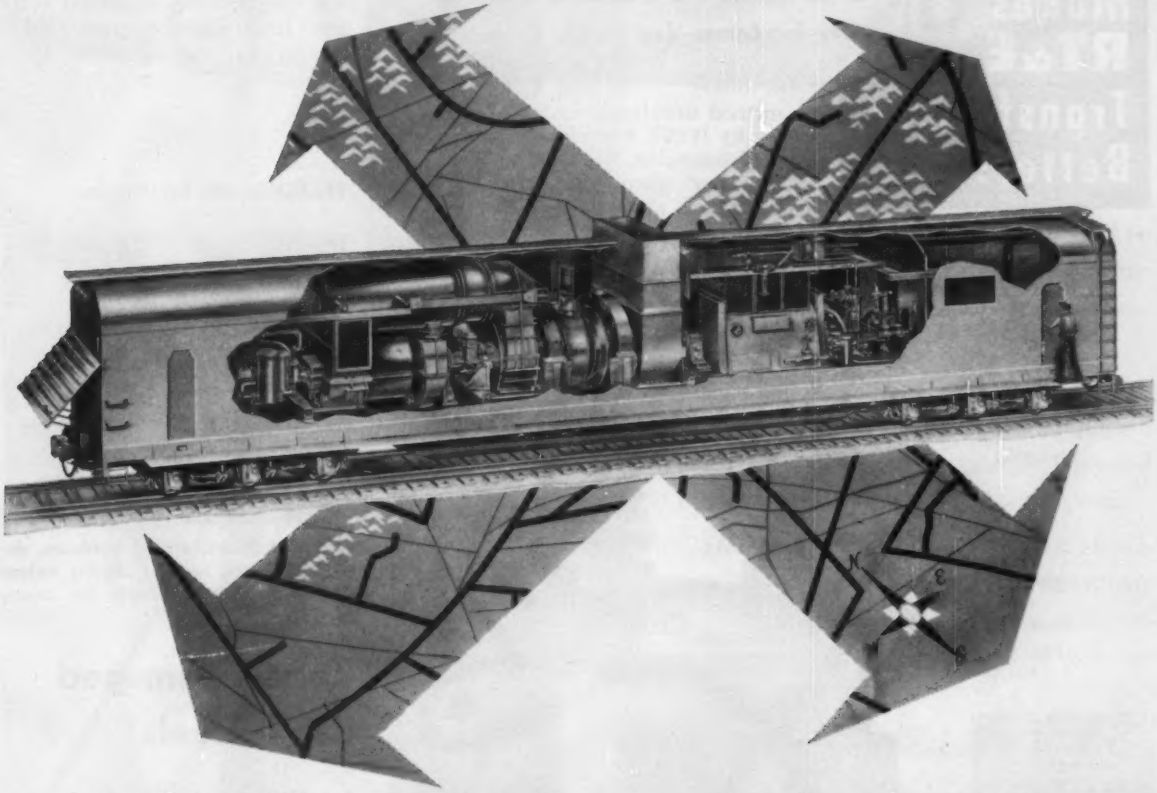
SPARK GAP across standard suspension insulator gives severe noise source

measured in a laboratory NEMA circuit and found to be 180,000 μv. By substituting the insulator for an existing unit on a 230-kv circuit and measuring the noise under the line, a ratio of approximately 100 was obtained of laboratory to under-line noise. Use of this ratio enables field results to be predicted from laboratory tests.

The noise source is a standard suspension insulator with a spark gap connected across it. Repetitive sparking occurs across the 0.1-in gap during each cycle of the power frequency, producing continuous noise which is radiated by the trans-

(Continued on page 74)

KILOWATTS



...where and when you need them

Heavy temporary electrical loads out at the end of the line present a serious problem to most electrical utilities particularly when the industry served is an important one.

There is, however, a practical answer to peak loads or emergency needs . . . the Clark Turbo-Mobile Power Plant. This gas-turbine-driven unit is a completely self-contained, rail car mounted, generating station. Burning liquid or gaseous fuels, it can generate up to 6,750 KW, measured at the generator terminals, anywhere that there are railroad tracks. And whether the "temporary" demand lasts for a day or a year doesn't matter. The Clark unit is designed for continuous 24 hour a day service for as long as required.

Stationary gas-turbine-driven generating units can also be provided. When equipped with a regenerator, a thermal efficiency of 29% is achieved at a KW output of 6,200. When used in a combined cycle, with the exhaust gases generating steam in a waste heat boiler, up to 10,000 KW can be generated at a thermal efficiency of 29%. Both efficiencies are based upon the fuel's low heat value.

Clark engineers are available to analyze your specific applications with regard to portable or stationary gas-turbine-driven generating equipment. Consult your nearest Clark representative.

CLARK BROS. CO., OLEAN, NEW YORK
One of the Dresser Industries
Offices in Principal Cities Throughout the World

CLARK **Portable Generating Equipment**

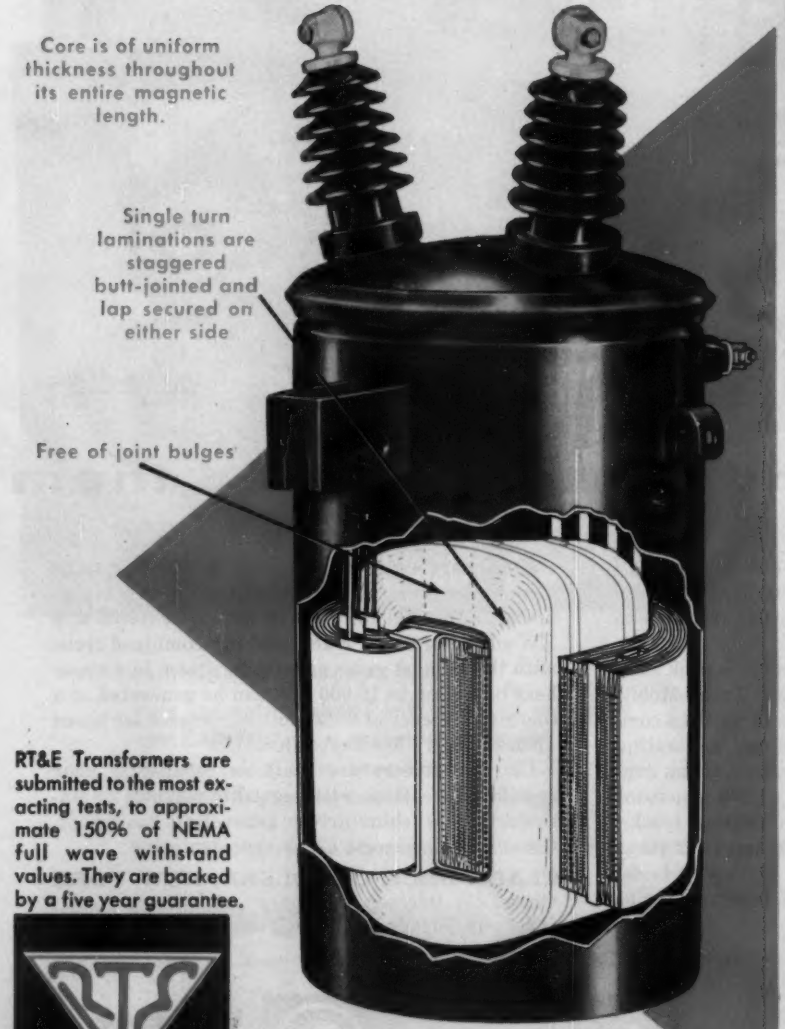
What Makes RT&E Transformers Better?

EXCLUSIVE WOUND-CORE CONSTRUCTION

Low Iron Losses—Low Exciting Currents

A method developed and used exclusively by RT&E forms the transformer core of non-aging, high permeability, cold-reduced, silicon steel strip.

This method produces RT&E's light, compact core, combining the best core features — low losses, low exciting currents, permanent characteristics and quiet operation.


Core is of uniform thickness throughout its entire magnetic length.
Single turn laminations are staggered butt-jointed and lap secured on either side
Free of joint bulges

RT&E Transformers are submitted to the most exacting tests, to approximate 150% of NEMA full wave withstand values. They are backed by a five year guarantee.

RT&E CORPORATION
WAUKESHA, WISCONSIN

EXCLUSIVE WOUND-CORE CONSTRUCTION—Another reason why RT&E is better!

Aids in HV Studies

(Continued from page 72)

mission line. Holes in the porcelain for mounting the spark gap were made by means of a magneto-striction vibrator using a steel rod as the drill. Brass machine screws filed to a point give the adjustable spark gap.

TRANSMISSION—Construction

WOODEN REELS, stored outdoors, deteriorated and needed repairs before the wire on them could be strung

Repair Damaged Cable Reels

A. L. KING, Field Engineer, Toledo Edison Co, Toledo, Ohio

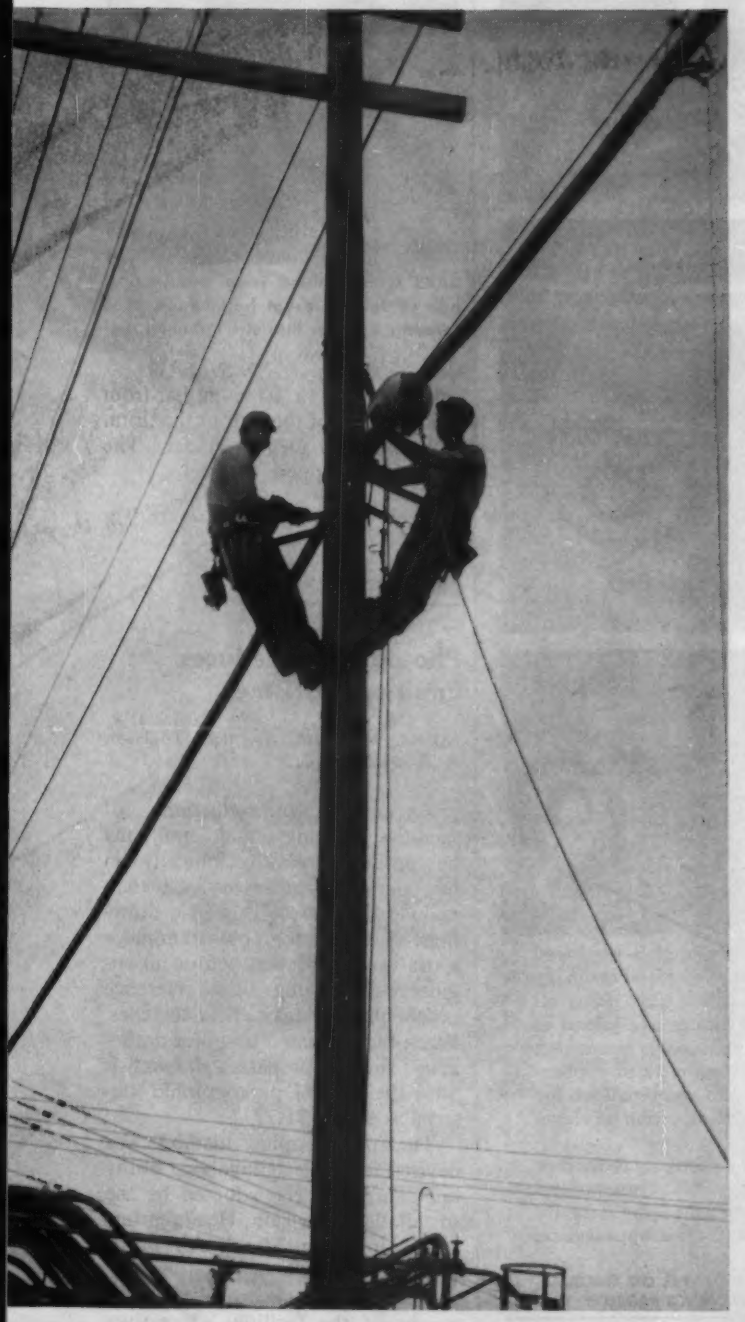
When deteriorated wooden cable reels broke during wire stringing operations, threatening a transmission line construction schedule, quick repairs were completed in the field by welding in a reinforcing spider. Conductor strung on a recently completed 138-kv transmission line had been left unprotected from the elements for several years. The wooden reels had deteriorated to such a state that removing the cable presented a problem.

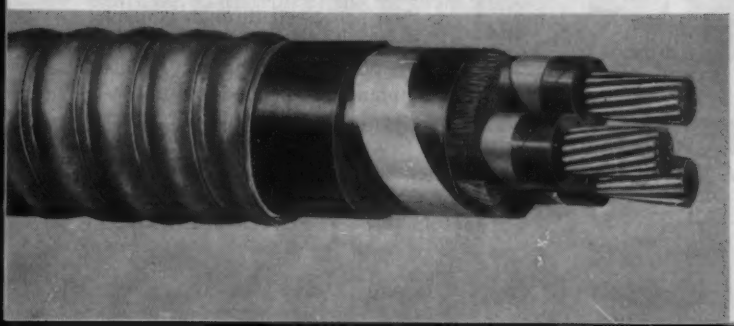
These reels contained approximately 8,200 ft of 336.4 MCM 26/7 ACSR weighing 2 tons. The friction between the axle and the hub was sufficient, even when lubricated, to tear the hub out of the wooden side member and chew out an oversized hole. The reel had to be repaired quickly so that the construction schedule could be held.

The problem was solved by weld-

(Continued on page 76)

Speed new power on old poles—cut costs with Anaconda Duralox Interlocked-armor Cable





METAL TAPE ARMOR AFFORDS HIGH PROTECTION AGAINST DAMAGE—NO CONDUIT NEEDED.

When a large Gulf Coast refinery needed additional power, the job was done *quickly* and *economically* because Duralox* could be strung on existing power-line poles—below the old lines. Neither new poles nor cross-arms were needed.

Installation time and costs are slashed with Duralox. Outdoors or in, it is readily trained around or over machinery, beams, piping and other obstructions in long, unbroken runs.

Duralox increases plant flexibility, affords easy maintenance and minimizes down time because it is generally accessible, easily relocated—100% salvageable. *Reg. U.S. Pat. Off.

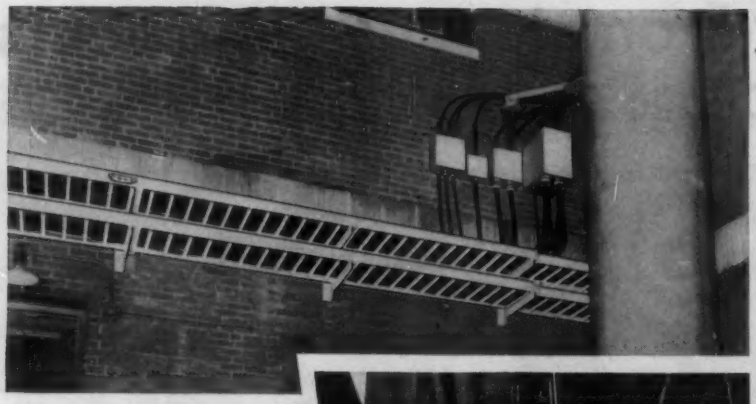
NEW BULLETIN DM 5606 contains full information about Anaconda Duralox Cable. Write for your free copy today. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

Ask the Man from

ANACONDA®
for DURALOX CABLE

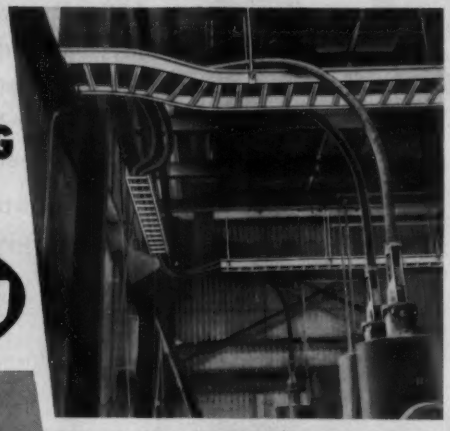
EXISTING POLES are utilized at well-known refinery for additional power. Cable is Anaconda's 4/0 Awg Duralox Interlocked-armor Cable.

DURALOX CABLE is available in sizes No. 6 Awg to 750 Mcm—copper or aluminum conductors with rubber, plastic, or varnished-cloth insulation—up to 15kv. Underwriters' approved for 600 volts and 5000 volts, varnished-cloth insulation, galvanized steel armor!



a new, superior system of CABLE and TUBING RACE WAYS...

Globetray
PAT. PENDING



A completely engineered system of cable ways, production produced and die formed for uniformity with up to twice the strength of ordinary trays, by actual laboratory tests. The universal splice plate joins all parts through the side channels only. All curved fittings are joined at the end of the radius (no tangent material is required) permitting continuous curves. This feature provides greater flexibility of application in tight places and creates an endless variety of combinations for a simple solution to any design problem of change of direction or elevation with a complete set of standard fittings.

Comes in 6", 12", 18" and 24" widths, in standard 12' lengths to further speed up installation time. Cable way can be cut to length at any point—insides and bottom always smooth—all sections punched for easy installation—perfect fit at all times. Neat, clean and uniform in appearance.

Globetray
THE GLOBE COMPANY

EASY TO INSTALL • SAVES TIME • SAVES ON MATERIAL
GALVANIZED • NO MAINTENANCE PROBLEM

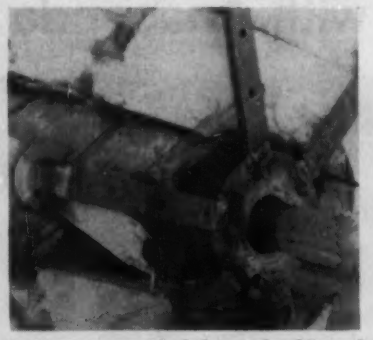
106

Write for new complete catalog. Distributors in all principal cities. Contact the Grip-Strut distributor under "Conduits" in the classified telephone directory.

PRODUCTS DIVISION The GLOBE Company
4030 S. PRINCETON AVE. • CHICAGO 9, ILL.

Repair Cable Reels

(Continued from page 74)



BARS were welded from shoulder of hub of reel to drum bolt heads, thus forming a spider that strengthened reel

ing pieces of 1¼ x 1½-in. bar from the shoulder of the hub to the drum bolt heads to form a spider. The spider can support the reel.

DISTRIBUTION—Planning

Photography Reduces Engineering Time

FRANK MALCOM, Electrical Engineer, Riverside, Calif.

Engineering reproductions of facilities, showing actual detail, may be produced photographically in less time and at lower cost than making detailed or isometric drawings. Such photography eliminates a draftsman's preparation of an engineering drawing from reference notebook drawings or field sketches. When the estimated cost of a draftsman's time to prepare a drawing is $25, the cost of photographic material is about $1.77.

The photographic method was devised for projects involving utility lines and has been adopted by the Installations Division, Headquarters 15th Air Force, March Air Force Base, Calif.

The first step is to take photographs of the facilities. Negatives are then processed through contact printing, using reprolith film to produce a positive transparency. This transparency is printed on photocopy sepia paper. Notes or other data are added to the sepia copy as required.

Advanced Design

Means: Reduced Weight / Easier Handling / Versatile Installation

Advanced design features make these Allis-Chalmers potential transformers smaller and lighter than ever before. This reduction in size and weight results in space-saving transformers that are easier to handle and simpler to install.

NEW compact design also results in improved performance in both ratio and phase angle.

NEW potential transformer ratings have been added to include higher voltage classes.

Best of all, with these smaller, lighter units, you still get all the maintenance-cutting, long-term economy features you expect from Allis-Chalmers.

ALLIS-CHALMERS Potential Transformers

POTENTIAL			
Two-Bushing Transformer			
TYPE	Insulation Class	Height	Weight
SPW-2	25	38½	280
SPW-3	34.5	40½	310
SPW-4	46	48½	615
SPW-6	69	61	1160
SPW-11	115	86	3400
Single-Bushing Transformer			
SPW-21	25	41	260
SPW-31	34.5	44¼	285
SPW-41	46	50¾	460
SPW-61	69	63¾	950
SPW-111	115	92	2310
SPW-131	138	112	3510

Get all the information on these modern lightweight transformers. Contact your nearby A-C district office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

LIVE BETTER ELECTRICALLY

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5125

Southwest Co-ops Boost LBE Activities

Texas, New Mexico co-ops get aboard the LBE bandwagon with banners, floats at local fairs. Find activities pay off

Evidence that Live Better Electrically is becoming more widely known and used continues to pour in. From the Southwest comes news of highlights in LBE activities among rural co-ops. Examples:

• Guadalupe Valley Electric Co-op in Gonzales, Texas, has featured LBE in its Information Bulletin since July, 1956. Banners and symbols are displayed prominently in its offices and have been used on a co-op float at the Guadalupe County Fair. Guadalupe Co-op, incidentally, has some impressive results from tying in LBE with the all-electric home. In Sept. of 1956, the co-op ran a story on the all-electric home in the Information bulletin. At that time there were 31 such homes on their system. Now there are 42, a gain of more than one-third!

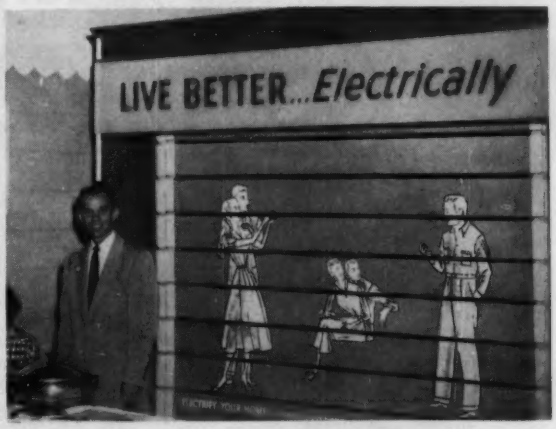
• New Mexico Rural Electrification Cooperative Association featured Live Better . . . Electrically at its booth at the New Mexico State Fair in September. At that time the co-op distributed the LBE questionnaire to more than 7,000 people, who also saw the LBE "venetian blind" display . . . a house with no electrical conveniences is flipped over to one with an array of the latest electrical services and appliances. (See illustrations).

• Comanche County Electric Co-op in Comanche, Texas, has supplemented its regular promotion activities with LBE. The co-op purchased "Meet Mrs. Swenson", and have been showing it to interested women's groups. W. J. Parks, co-op manager, reports that range sales in his territory have been boosted substantially since the inclusion of LBE.

• DeWitt County Electric Co-op, Cuero, Texas, used LBE as a theme for its float in the "Cuero Turkey Trot". (An affair of some proportions, we're told). LBE was also used at the co-op's exhibit. Some 70,000 people saw the exhibit.

• In New Mexico several co-ops use LBE on floats and exhibits to help sell electrical living. In five or six are boosting residential consumption with LBE. In Texas, about 20 co-ops are tying-in Live Better . . . Electrically with programs to build residential sales. A number of co-ops in Louisiana and Oklahoma are doing the same things.

Generally, it looks as though co-ops—those in the Southwest, anyway—are climbing aboard the LBE bandwagon. Will others follow suit?



Co-op sign showing no appliances . . .

flips over to modern electric home

NRECA Conference Includes LBE

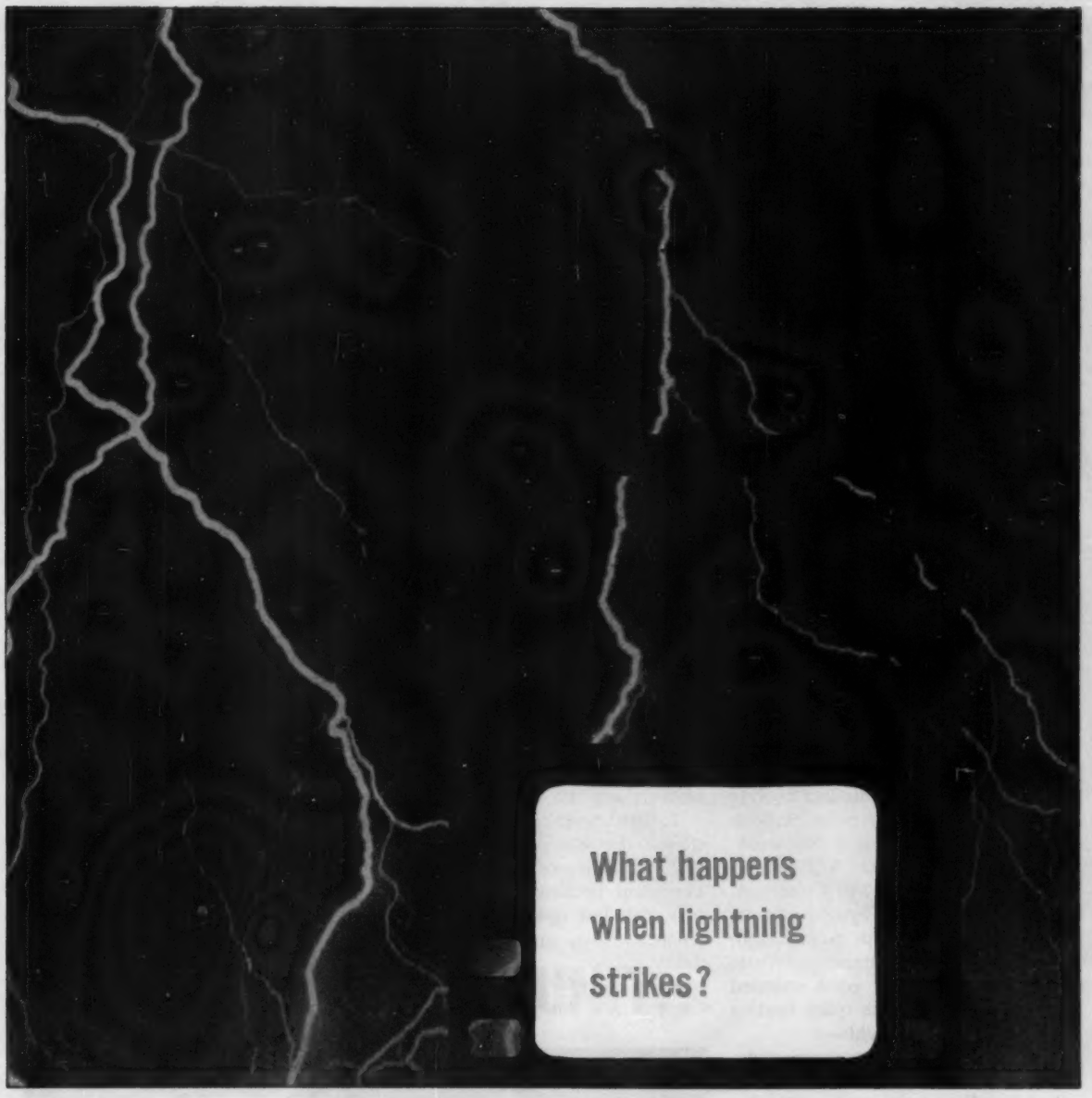
There's a good chance many of them will if the recent annual convention of the National Rural Electric Cooperative Association is any indication. LBE figured prominently there.

More than 20 exhibitors featured Live Better . . . Electrically in their booths. A 70-ft "Live Better . . . Farm Better . . . Electrically" sign hung over the stage at the meeting auditorium in Chicago's Coliseum.

A ladies panel discussion before some 700 women discussed the subject of living better electrically in the farm kitchen. Interest ran high.

What may be a trend toward increased merchandising on the part of the co-ops was evident in the other LBE discussion headed by Bill Troy, LBE's association activities man, on the matter of effective member and public relations. Troy also spoke on how the co-ops might effectively list support for LBE.

(*More Selling on page* 80)



New Hubbard Film Demonstrates Lightning Arrester Operation

The subject of power system lightning protection is complex and difficult to explain by conventional methods. This film, using new techniques of animation and ultra-high speed photography, facilitates the understanding of the many variables entering into the problem of lightning protection.

Produced in the Hubbard Research Laboratories especially for utility personnel, this film entitled "The Magic Cylinder" details formation of natural lightning, the effects of lightning on a power system, the duty on arresters, and the operational characteristics of the types in current use.

In full color and sound, with running time of 28 minutes, the picture is without counterpart in its educational coverage of this complex subject.

You can arrange for a showing of this brand new color film by contacting the Advertising Department of Hubbard and Company, 6301 Butler Street, Pittsburgh 1, Pennsylvania.

HUBBARD AND COMPANY

Pittsburgh 1, Pa. • Chicago, Ill. • Oakland, Calif. • Plano (Dallas), Texas

AEP Hosts Electric A. C. & Heating Symposium

Utility and manufacturers bring together architects and engineers in conference believed to be first of its kind. More than 200 get facts on heat pump, resistance heating, other types of electric heating & cooling

Here's another way for your utility to promote electric heating and cooling in your area:

If your name is Appalachian Electric Power Co, you get together with some prominent electric heating and cooling equipment manufacturers and sponsor a symposium for architects and engineers. Furthermore, you stack the speaker list with some of the best brains in the industry, and you let them talk to their audience in terms they both understand. You stay away from sales pitches, sticking to the subject itself. You trace equipment developments, give market patterns, and make sensible, informed predictions. Result: You have about 200 architects and engineers who know much more about the heating and cooling picture, and who are more likely to incorporate more of it in their work.

This is exactly what AEP did. At a 2-day All-Electric Air Conditioning and Heating Symposium in Roanoke, Va., two weeks ago, architects and engineers from AG&E areas got a good rounded out picture of electric space heating and cooling. Highlights—

• Air conditioning equipment development, from motor-driven, central installations to packaged units, was a major subject. So were A.C. distribution systems. Leading engineers from firms such as GE, Worthington, Westinghouse, Carrier, Trane, Wiegand, Electromode and York covered the field.

• Resistance heating is gaining, especially in schools. Some people think they spot a trend here. Actually, schools have been heated electrically for more than a decade in areas with low rates, but now other factors are at work. Energy costs are becoming less important in the over-all analysis. Big savings accrue in initial cost to taxpayers because electric heat eliminates boilers, boiler rooms, chimneys, pipes and ductwork. Energy costs are usually lower than is generally realized. Heat gain from pupils, lights and the sun cut 'way down on consumption. This is the gist of speeches by Electromode's R. L. Boyd, Jr., and Wiegand's W. L. Thompson.

• Heat pumps were not overlooked. They are gaining acceptance in areas where they've been previously considered impractical. The future of the packaged heat pump is an inviting one, according to GE's H. M. Brundage. He predicts:

1. Water and ground-source units, which make up 32% of the present heat pumps installed, will drop to 5% by 1961 because of their limitations. Air source units, he feels, are the coming thing.

2. 1961 will see 67,000 units installed. Growth is 74% a year.

3. Multiple installations will be important because they afford low first cost, low operating and maintenance costs, and inherent flexibility.

• But don't forget the larger "custom" heat pump job. G. L. Seay, whose engineering firm does "feasibility studies" prior to all jobs for clients, points up the following possible heat pump advantages.

1. Heat pumps can capitalize on promotions—before and after the installation.

2. The heat pump may be a more progressive and modern installation for a longer time.

3. Cost of oil seems to be increasing relative to that for electric power.

4. Heat pump users could be more independent of strikes or international incidents affecting the supply of oil.

5. Heat pump is clean—no smoke, fumes or combustion.

6. No fuel storage, boiler room or flues are required.

Reaction to the meeting was good. Generally, participants and audience felt it well worth their time. AEP has pointed the way. Will others follow?

(More Selling on page 84)

UTILITY, ENGINEER and MANUFACTURER were represented at air conditioning & heating symposium. L. to R, Gilbert Seay, of Hayes, Seay, Mattern & Mattern, engineering firm of Roanoke, Va, W. L. McGrath, Carrier Corp, J. B. Napier, American Gas & Electric, and H. M. Brundage of GE, Weathertron Division

NEW, COMPACT "FMU" METERING UNIT...

up to 42% smaller, 62% lighter

The new line of all-weather outdoor metering units —Westinghouse Type "FMU"—with up to 35% less base area maintains the high accuracy and dependability of its predecessor, the Type "MP". Utilizing compact Form-Fit® design, the completely sealed "FMU" outfit reduces oil content—as much as 56%. Installation is simplified and speeded by weight reduction—up to 62% in the highest rating.

The new "FMU" metering unit, combining both current and potential transformers in one case, when compared with separate components, provides a smaller, neater package, with fewer connections and less installation time. Current ratios can be changed externally, by means of a series-parallel switch for each current element . . . an indicator, easily read from a distance, shows the type of connection.

Available for single- and three-phase service, with primary current ratings 10/20 through 400/800 amperes in 25-, 34.5-, 46- and 69-kv ratings.

For the complete story, call your Westinghouse representative . . . or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-70803

YOU CAN BE SURE...IF IT'S Westinghouse

This turbo-generator at Oak Creek is a 120,000 KW, cross-compound, hydrogen-cooled unit. It consists of a 3600 RPM high pressure-intermediate pressure turbine driving an 80,000 KW generator, and an 1800 RPM low pressure turbine driving a 40,000 KW generator.

The fourth boiler and turbo-generator will be installed in the foreground. To the left of the building is a coal dock with storage capacity of a million tons. Coal is delivered by self-unloading Lake steamers which discharge at rate of 2,000 tons per hour.

In this control room at Oak Creek, Honeywell instruments measure, indicate, and record critical operating temperatures.

Wisconsin Electric's Newest Power Plant

has HONEYWELL *instrumentation to help harness 500,000 KW*

Located on Lake Michigan south of Milwaukee, Oak Creek Power Plant is Wisconsin Electric Power Company's newest, most modern station. Three units now in operation and a fourth under construction will bring the plant's total capacity to 500,000 KW. Additional future units are being planned at this location.

As in other outstanding power plants across the nation, Honeywell instrumentation figures prominently in the overall efficiency of Oak Creek. These accurate controls bring extra economy to the transformation of coal into kilowatts. Here, as in every Honeywell installation, service from the world's largest maker of automatic controls is close at hand for periodic maintenance and fast assistance in emergencies.

For experienced service in meeting your own instrumentation needs, call your nearby Honeywell sales engineer. He's as near as your phone.

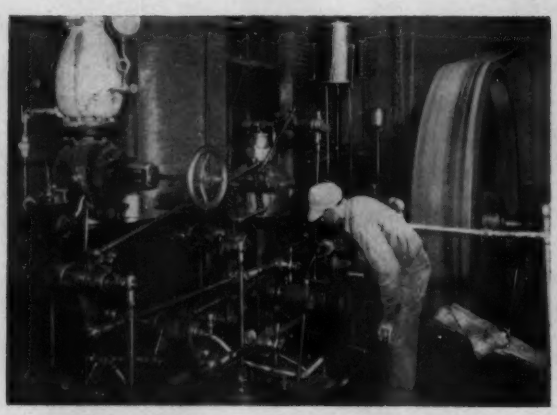
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Aves., Phila. 44, Pa.—in Canada, Toronto 17, Ontario.

H HONEYWELL

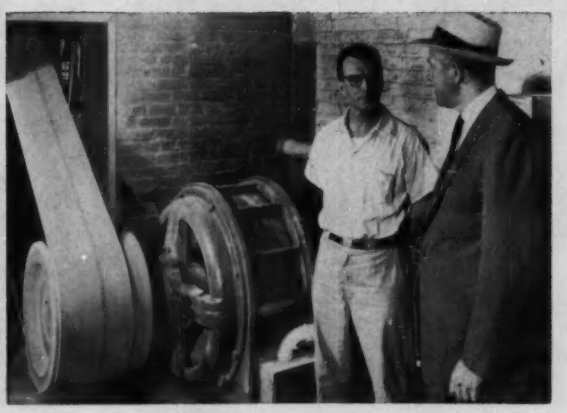
MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls



Replacing "economical" steam plant . . .



with new 100-hp electric motor and . . .

Purchased Power Saves $14,000 Per Year

C. H. WHITBY, Industrial Power Sales Engineer, Baltimore Gas & Electric Co, Baltimore, Md.

A switch from a locally operated steam engine to purchased electric power is saving an estimated $14,000 per year in the wood molding plant of Milton W. Bosley & Co, Inc, Baltimore, Md. Moreover, the new 100-hp electric motor has eliminated numerous delays and difficulties caused by the 125-hp engine it replaced. There are no shutdowns for repairs. Maintenance costs have tumbled sharply. And the man-hours used to operate the old boiler and steam plant can be put to more productive use. In addition, plant management is highly pleased with the improvement in operating efficiency.

Scrap lumber and shavings from the cutting and embossing operations were used as fuel in the old boiler. Since these fuels were free and the boiler provided a convenient way of disposing of these wastes, it appeared to be a highly economical operation.

However, an accurate analysis of the actual operating costs, conducted by the Industrial Power Dept of the Baltimore Gas & Electric Co showed that the cost of power for the engine was exorbitant compared to the cost of purchased electric power. Considerable labor was required both to fire the boiler and to operate the steam equipment. Maintenance costs were high. Shutdowns for repairs and other operating difficulties often held up production.

Most of the machines—molders, saws, embossers—are individually motored and use 100-cps current to produce speeds up to 6,000 rpm. The finish produced by this high speed cutting is as smooth as a sanded surface. Bosley's moldings are used in the manufacture of picture frames.

Screw Selector Saves Time, Cuts Errors

M. L. BETTINGER, Power Sales Engineer, The Toledo Edison Co, Toledo, Ohio.

A novel system for selecting one of several different test voltages is saving time, eliminating errors, and reducing hazards to operating personnel at the Haughton Elevator Co plant in Toledo, Ohio. The system saves 10 to 15 minutes set-up time per job and can be used by mechanically trained men who are not electricians with fewer errors than the previous method.

The operator uses four pushbuttons—labelled 440, 220, 208, GEN—at the test site to control a remote, motor-driven 3-pole screw selector. When one of the buttons is pushed, relays in the switching unit set up a holding circuit, open the main contactor, and drive the selector up or down the screw until the chosen position is reached. The main contactor then closes again and an illuminated cut-out on the pushbutton panel indicates the voltage selected.

The pushbuttons marked 440, 220, and 208 energize 3-phase, 60-cps supplies at these voltages. To obtain 220/440-v, 25-cps or 115/230-v d-c supplies, the operator pushes the GEN button, then calls the generator room on an adjacent phone to have the proper voltage switched to the generator lines.

The selector switch is driven by a ¼ hp, low torque motor. A toggle switch on the pushbutton panel can be used to de-energize the entire switching assembly. Maximum current load of the selector is 150 amp on the 440-v contacts.

Before the new system was installed, test personnel set up the desired voltages with open switches on the far side of the room. The motor driven selector was conceived by the plant electrical supervisor.

KUHLMAN *"Salesman of the Week"*

If you can identify this Kuhlman Electric Co. representative, and are the first one to notify Dept. SA-1, Kuhlman Electric Co., Bay City, Mich., you will receive a valuable gift certificate. Watch for the next Kuhlman "Salesman of the Week."

"WHEN I SAY KUHLMAN CLEARVUE TRANSFORMERS INVITE YOUR INSPECTION . . . .

. . . I simply mean that just one look inside a Kuhlman clearvue transformer invites easy, fast, thorough inspection. The interior is so white and clean. The oil is crystal clear. Every component from the top oil to the tank bottom is sharply visible.

"With such ideal working conditions, all inspections, adjustments and reconnections can be made right on the pole without transformer removal.

"Frankly, it amazes me that Kuhlman offers this exclusive feature at no extra cost. For, in addition to being white, clearvue is processed by the most modern dual-flow paint system known today—the very same as used for exterior finishes. You just cannot buy a more durable interior.

"Clearvue is only one of the many refinements that prove the extra-quality and extra-workmanship in Kuhlman distribution transformers. Make the Kuhlman clearvue inspection yourself and you'll see what I mean."

KUHLMAN ELECTRIC COMPANY

5711e

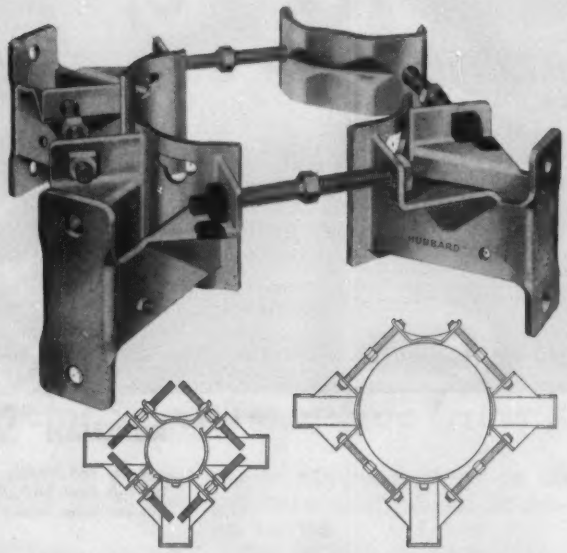
BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

Power Capacitors

Varex power capacitors are available in both 25-kvar and 50-kvar units for voltages from 2.4 kv to 7.96 kv. The foil cooling used in these units is said to be highly efficient. Individual elements of insulating paper and aluminum foil are set in unit horizontally so container sides act as radiating surface.

Manufacturer claims units fit all existing racks and hangers. Case has epoxy-resin paint which is reported to have good flexibility and adhesion and high corrosion and abrasion resistance. Equipments are factory wired and can be supplied with or without switches.

Ohio Brass Co, Mansfield, Ohio

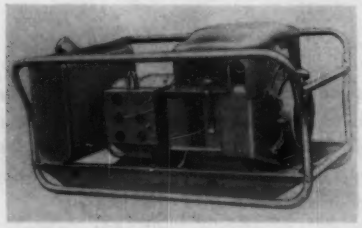


Transformer Mount

Hub-Mount brackets are for mounting of 1, 2, or 3 transformers on individual poles between 6.5 and 16 in. in diameter. Consisting of 1, 2, or 3 mounting boxes and quarter plate held together by turnbuckle bolts, they reportedly provide 30-in. climbing space on 8-in. pole and greater clearance on larger poles.

Single Hub-Mount weighs 37 lb. Vertical adapter plates for 3 to 15-kva transformers weigh 5 lb each; horizontal plates for 75 to 167-kva units, 7.75 lb each.

Hubbard & Co, 6301 Butler St, Pittsburgh, Pa.



Portable Generator

The Model 5CCK-115P portable electric generator is rated 5 kw, 115 v dc. Electric generator is directly connected to 4-cycle, two-cylinder, 12.5-hp gasoline engine. Designed to supply power for lighting, tools, and motors, the entire unit weighs 315 lb and is said to be of drip-proof design.

D. W. Onan & Sons, Inc, 2515 University Ave S. E., Minneapolis 14, Minn.

Frequency Meters

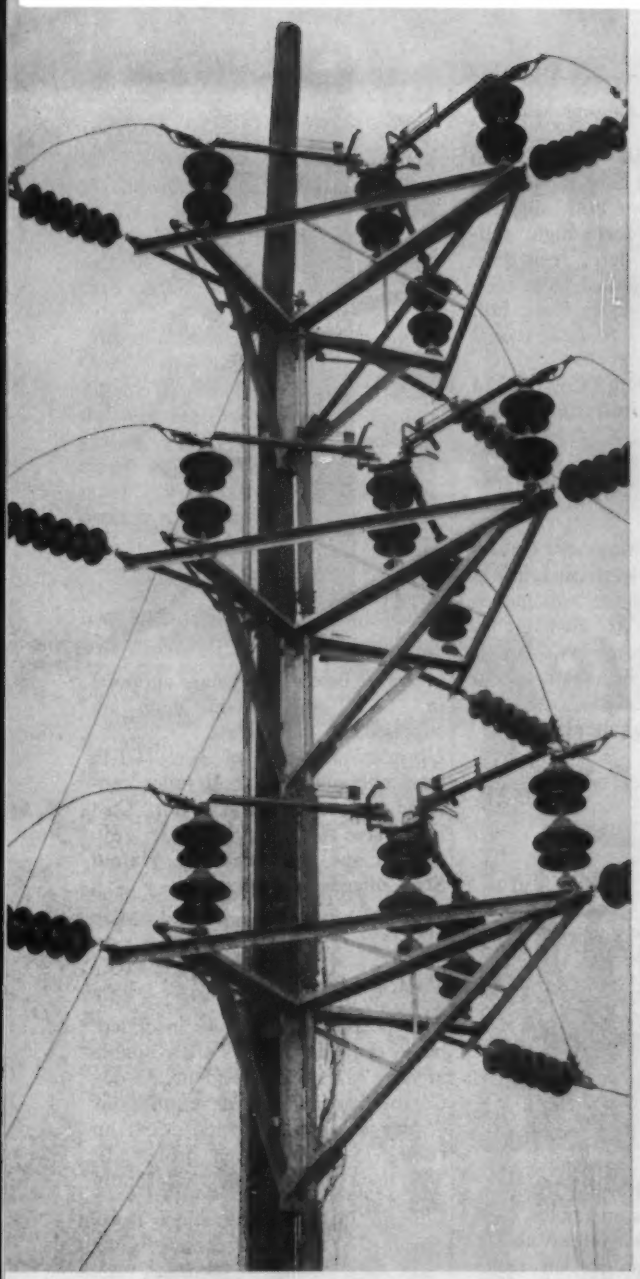
The PFM electrical frequency meters are reported to have a frequency accuracy of 0.1% for a 120-v ± 35% source at a constant ambient temperature. The meter consists of a 3-in. D'Arsonval galvanometer and a 2-in. by 3-in. by 1.5-in. case containing the potted circuitry. Standard models, with operating frequencies and scale expansions are: PFM 50, 50 ± 2 cps; PFM 60, 60 ± 2 cps; PFM 400, 400 ± 20 cps; PFM 5060, 50 ± 2 cps, switchable to 60 ± 2 cps. Power consumption is 1 w.

Alexandria Div, Defense Product Group, American Machine & Foundry Co, 1025 N. Royal St, Alexandria, Va.

Reel Racks

Reel racks which are adjustable for reels from 48-in. 500 Mcm to 12-in. No. 14 wire are available in

(Continued on page 88)



Save your company money and improve switching efficiency by standardizing on the

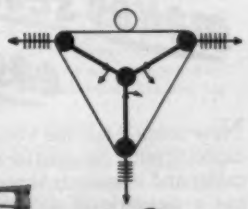
NEW CHANCE GOABS

the latest advance in "packaged" switching

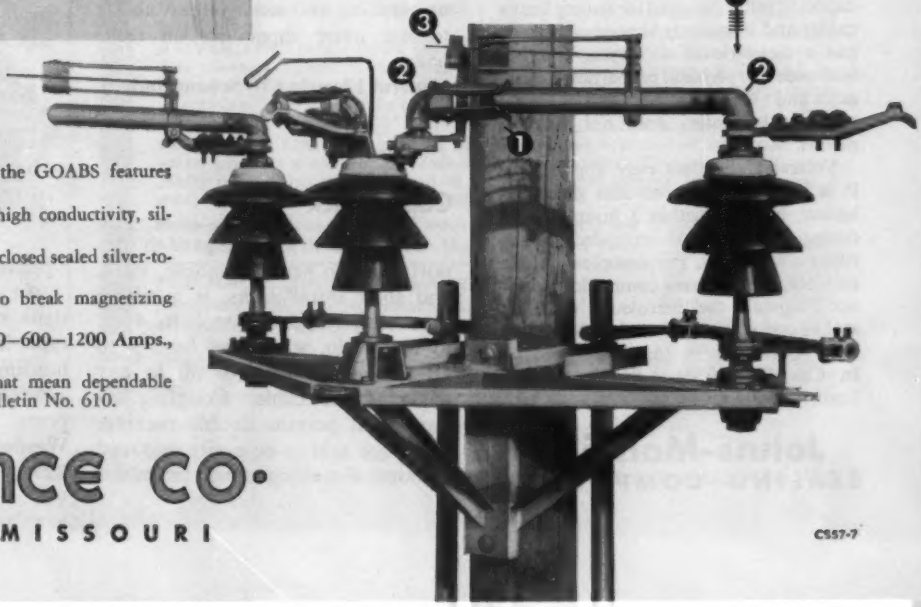
Many engineers have saved their companies as much as 25% on the cost of tap switching installations by using GOABS instead of conventional air break switches. GOABS require no more right of way than the pole line itself—only one pole is needed for either 2 or 3 way switching.

Now you can get better switching than ever before with the New type "GS" GOABS because they're built like the field proven Chance Type "S" Side Break Switches with all their finest performance features. But that isn't all—the new GOABS have fewer insulators per phase for greater savings in installation and maintenance costs... up to 30% less weight... better balance. GOABS are pre-assembled, "packaged" switches ready for mounting. This means convenience and accuracy in field installation—one piece welded frames require no bolting together. Units are balanced for easy hoisting up the pole... permanently lubricated for minimum maintenance.

Only 3 insulator stacks on 2-way switching



Only 4 insulator stacks on 3-way switching



Here is a typical 3-way installation of CHANCE Type "GS" GOABS (Group Operated Air Break Switches)

The two-way at right shows some of the GOABS features that guarantee reliable performance.

1 High pressure contacts—self-wiping, high conductivity, silver to copper.

2 Braidless Construction—completely enclosed sealed silver-to-silver hinge contacts.

3 High-Speed Snap-Out Arcing Horns—to break magnetizing and charging currents.

Full NEMA Rated—7.5 to 69 KV, 400—600—1200 Amps., 2-way and 3-way.

Plus many more important features that mean dependable performance—Get the full details in Bulletin No. 610.

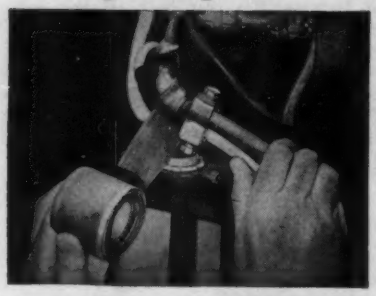
A·B·CHANCE CO.

CENTRALIA, MISSOURI

CS57-7

Volseal...

the new high dielectric putty...



makes sealing easier!

NEW Johns-Manville Volseal is a high dielectric putty designed for sealing heavy cables and irregularly shaped objects. It has a dielectric of 445 vpm, together with excellent physical properties. Resists acids and alkalis, weathers well, is highly resistant to water, does not corrode metals.

Volseal also offers easy application. It is highly elastic, provides good adhesion, hardens within 3 hours on air curing. Available in extruded beads, ribbons and pugs. For complete details on Volseal and its new companion product Napseal, the petroleum resistant sealing compound, write Johns-Manville, Box 14, New York 16, N. Y.
In Canada, 199 Bay Street, Toronto 1, Ontario.

Johns-Manville
SEALING COMPOUNDS

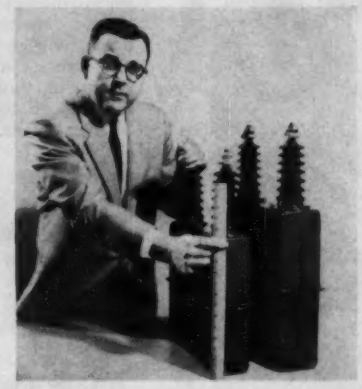
Reel Racks

(*Continued from page* 86)

four models: wall model with double reel height; floor model that supports loads from both sides, 2 reels deep and 2 reels high; self-supporting floor model, 2 reels deep and 2 reels high, loaded from only one side with lift truck or chain fall; undertable model, 4 ft high, 1 or 2 reels deep.
Weber Electric Mfg Co, 15224 Kercheval Ave, Detroit 30, Mich.

Capacitor

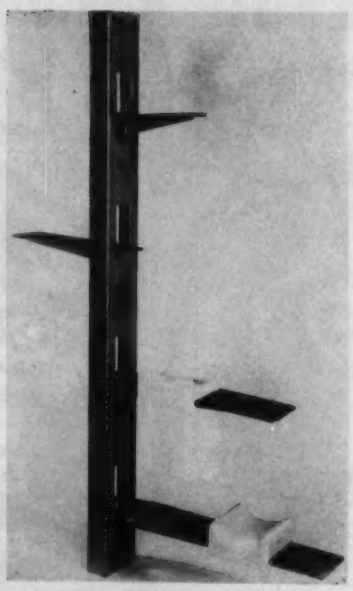
Available for ratings of 4.5 kv and above, this 25-kvar capacitor is said to be 19 lb lighter, two inches shorter, and four to five inches thinner than the company's previous models. It can be substituted in all equipments designed for the larger 25-kvar equipments.



Reported advantages are low weight on crossarms and poles, ease in handling and storage, and ability to use more capacitors on some poles.
General Electric Co, Schenectady 5, N. Y.

Cable Rack

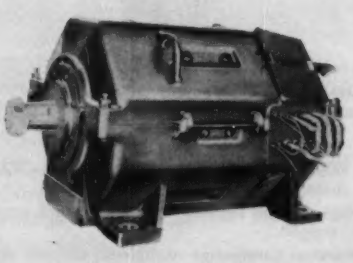
The Type S rack, designed to support cable in heavy manhole, vault, and shaft installations, is available in overall lengths from 1 ft, 4 in. to 3 ft, 4 in. with arms from 5 to 18 in. long. Arm will tilt to any angle of the cable. Coupling arrangement permits double racking. Arms are said to be easily removed without disturbing arms or cables



above or below. Porcelain supports in 1¼-in. and 2½-in. diam are supplied.
Uprights are made of 3-in., 4.1-lb steel channel, with bolt holes centered between each arm slot. Cast arms have two to six holes per arm.
T. J. Cope, Inc, Third & Walnut Sts, Collegeville, Pa.

Mill Motor

Type 620 mc silicone insulated, heavy duty mill motors are available in three sizes: 275 hp (1-hr, 75-deg C, totally enclosed or continuous 75-deg C open protected); 350 hp (1-hr, 75-deg C, open protected); 360 hp (½-hr, 75-deg C, totally enclosed).



An extension of the 600 series, these motors have cast-steel, split-type frames, integral bearing and housing assemblies, and large diameter shafts between bearing supports.
Westinghouse Electric Corp, Box 2278, Pittsburgh, Pa.

More New Products

International Register Co, 2620 W. Washington Blvd, Chicago 6, Ill. offers Intermatic **time switches** in three models: V27,000 for operations of 5 to 15 min.; V28,000 and V29,000 for timing ranges of 2 to 60 sec.

International Business Machines Corp, 590 Madison Ave, New York 22, N. Y. has an Automatic Production Recorder **data collecting system** which collects, correlates, stores and records data in punched tapes and cards while a production process is underway.

Industrial Electronic Engineers, 3973 Lankershim Blvd, North Holleywood, Cal., offers an In-Line **digital display unit** for projecting numbers or characters from computers, alarm systems, meters, or control systems on a one-plane presentation.

Sel-Rex Corp, Newark, N. J., offers a Jet-Plater portable, automatic **electroplating unit** in 10, 20, and 30-gal capacities for plating electrical and other precision components with precious metals.

Western Railroad Supply Co, 2428 S. Ashland Ave, Chicago 8, Ill., has a Model 100-B12 two-speed **hydraulic lifting jack** with a capacity of 100 tons and a lifting height of 6⅛ in.

Optron Corp, 3526 State St, Santa Barbara, Cal., has available Optron **displacement followers,** an optical device for measuring amplitude, frequency and waveform of relay contacts, vibration pickups, shake tables and accelerometers.

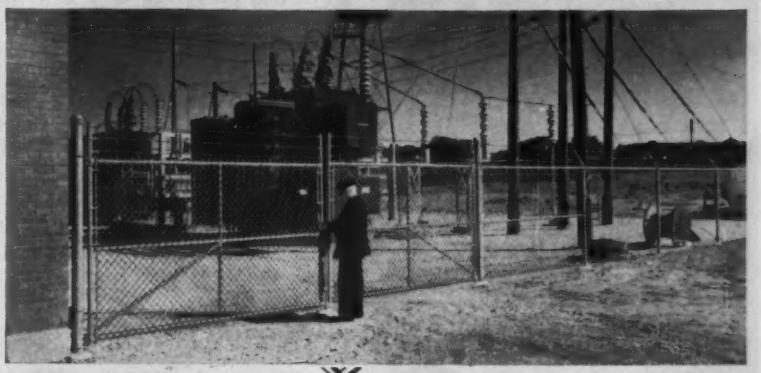
Partlow Corp, New Hartford, N. Y., offers a Model HL 15-10 high **temperature limit control** with scale and element ranges of 0 to 900F and 0 to 1100F.

General Electric Co, Cleveland 12, Ohio, offers bulged tubular white **mercury reflector lamps** for industrial, street, and general outdoor lighting. Model H400-EW1 is rated 23,000 lumens; H400-RW1, 22,000 lumens.

(*More New Products on page* 90)

How to Get More for Your Fencing Dollars...

PAGE Offers the Widest Choice to Best Meet Your Needs!



PAGE chain link FENCE

America's First Wire Fence—since 1883

Your property protection should be and can be MORE than just a fence. It can be the RIGHT fence for you because you can make decisions from the widest variety of choices available anywhere. Every part of your fence will be quality controlled by PAGE from metal billet to the complete, erected fence.

You can choose from —

- 8 Fence Styles
- 8 Fence Heights
- 4 Fabric Metals
- 2 Types Metal Posts
- 6 Gate Styles, Many Widths
- Single or Double Barbed Wire Arms
- Top Rail or Top Wire

Important Advantages for You

PAGE pioneered in providing a wider choice of long-lasting fence fabric metals. Each of them possesses characteristics which meet individual preferences or make it more suitable to meet certain climatic or service conditions.

GALVANIZED STEEL • PAGE fabric of this class is woven of time-proved basic open-hearth steel wire, hot-dip galvanized after weaving to assure long, reliable service.

ALUMINIZED STEEL • By a PAGE patented process a coating of commercially pure aluminum is bonded to steel wire to provide longer corrosion resistance, yet its cost is comparable with fence fabric having shorter life expectancy.

ALUMINUM • Another material in the non-corrosive class. It will not rust nor will it discolor materially under unfavorable conditions. Because of the PAGE method of semi-flat weaving it has exceptional strength.

STAINLESS STEEL • This special chrome-nickel fence fabric is immune to practically all corrosive elements and is particularly advantageous near salt water and where the air is laden with smoke, sulphur or other factory emissions.

MANY STYLES—MANY VARIATIONS • Ready to meet your needs are 8 styles, varied by heights, gauges of fabric wire, units of supporting structure, types of gates (all with welded frames) and barbed wire strands for added security.

ALSO VERY IMPORTANT • The superior quality of materials and the specialized production skills represented by all PAGE FENCE parts are matched by the capable planning and expertness with which your fence will be erected. The Association member firm nearest you will confer with you on all details, offer sound recommendations and submit cost estimates without obligation. This localized firm has continuing interest in every fence it erects.

Write or send coupon for full information. With it we will send name of Association Member nearest you.

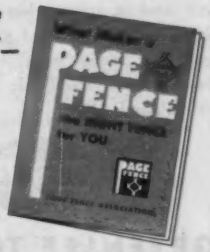
PAGE FENCE ASSOCIATION, Dept. W, Monessen, Pa.
Please send me detailed information on PAGE CHAIN LINK FENCE

NAME_____

POSITION_____

COMPANY_____

CITY, ZONE & STATE_____



A PRODUCT OF PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE CO., INC.

full 90° bend with one stroke of the ram . . . easy portability . . . extra versatility

Here's the kind of real portability you've been looking for in a bender for ½" to 2" pipe and conduit. Using light, but strong, aluminum alloy for many parts, the new GREENLEE No. 880 Hydraulic Bender is unusually *lightweight*, yet extra rugged, fast, powerful . . . produces 15 tons of ram force! One man can easily carry and operate it to quickly make uniform bends. Complete 90° bends can be made with one ram stroke. Separate two-speed hydraulic hand pump and bending ram simplify handling and setup. Easily operated by hand or may be teamed with a GREENLEE Power Pump for fast production jobs.

Attachments also available for bending thin-wall conduit, tubing, bus-bars. Get complete details on how to speed jobs and get better results with the new GREENLEE No. 880 Bender. Write for Bulletin E-217.

GREENLEE

GREENLEE TOOL CO.
1804 Columbia Ave., Rockford, Illinois

More New Products

(Continued from page 89)

Reliance Steel Products Co, McKeesport, Pa., markets a Relgrit non-skid **abrasive surface** for gratings and treads on walkways, stairways, and platforms. Said to resist most acids and alkalis and be effective under adverse conditions.

Gould-National Batteries, Inc, Trenton 7, N. J. has five models of a Rite-Hite **battery cell filler** which automatically adds the proper amount of water to batteries without overflushing. In vertical or horizontal models for industrial trucks and other industrial uses.

Gulton Industries Inc, Metuchen, N. J. offers a Model 501-A Glennite differential **pressure switch** to make or break circuit. High operating pressure, 250 psig; low, 500 psig.

Motorola, Inc, 4501 W. Augusta Blvd, Chicago 51, Ill., offers a Quik-Call **selective calling console** for base station installations of land-mobile two-way radio systems. Includes tone generator, timer, code selector, and power supply.

Electro Devices, Inc, 4025 Easton Ave, St. Louis 13, Mo., offers an Electro-pane miniaturized **annunciator** which indicates normal, alarm, pending or clear conditions with different colored lights.

Mathias Klein & Sons, 7200 McCormick Rd, Chicago 45, Ill., offers an electrician's **skinning knife** whose flame resistant plastic handle has high dielectric properties and is molded in a finger guard.

Massa Laboratories, Inc, 5 Fottler Rd, Hingham, Mass., has a Model M-133 **pen motor** for multichannel recording systems. Reported frequency response, with constant input, is flat from dc to 60 cps; down 12 db per octave from 60 to 200 cps. Sensitivity of 20ma rms full scale claimed.

Arrow-Hart & Hegeman Electric Co, Hartford, Conn., offers a 20-amp **magnetic relay** for all types of fractional and integral hp motors. Available in 2, 3 and 4-pole models at all standard voltages up to 300 v.

Magnus Chemical Co, Garwood, N. J., has a Solvent No. 5 noncombustible **cleaner** for removing oils and grease from electric motors, switches and parts by immersion, brushing or spray.

Mack Electric Devices, Inc, Wyncote, Pa., has available a Thermo-Alarm self-contained, automatic **temperature alarm** for refrigerators, sterilizers, vaults and other critical temperature applications.

Cincinnati Sub-Zero Products, Reading Rd at Paddock, Cincinnati 29, Ohio, offers a Model U-70-6 **chilling machine** for testing stability of wire insulation at temperatures of —10 to —80F. Reported capacity is 200 btu per hr at —70F under normal ambient conditions.

Automatic Transportation Co, Div of Yale & Towne Mfg Co, Chicago 20, Ill., has an Automatic Transporter operator-led, electric-driven **industrial truck** with a built-in battery and charge unit. Can be recharged whenever truck is not in use by connecting charger cord to 115-v line.

Allen B. Du Mont Laboratories, Inc, 750 Bloomfield Ave, Clifton, N. J., has available a Type 405 **vacuum tube voltmeter.** DC, 2 mv to 1 kv, nine ranges, 121 megohm input resistance; AC, 10 mv to 300 v; ohmmeter, zero to 5,000 megohms, eight ranges. Dual or differential voltage measurements.

General Electric Co, Schenectady 5, N. Y. offers **vitreous enameled resistors** covering the range from 5 to 200 watts, fixed or adjustable. Available in wide variety of mountings in both stock and made-to-order ratings.

Mid West Body & Mfg, Paris, Ill., offers a Jiffy-Lift **electric elevating tailgate** for ½ and 1-ton trucks. Said to lift 600 lb in 15 sec.

Selas Corp of America, Dresher, Pa., has a Liqui-Jector **liquid-gas separation** device for removing entrained liquids and solids from air, gas and steam systems. Series A, volumes to 100 scfm at 150 psig; series B, to 7,000 scfm at 200 psig; series C for unusually large volumes of condensate. Twelve sizes.

CATALOGS—BULLETINS

• GENERATOR WINDING COOLING: Bulletin 1200 describes the most recent developments in coolers for generator windings. It has been prepared by Griscom-Russell Co, Massillon, Ohio.

• SYNCHRONOUS TIMING MOTORS: A data sheet describing its new synchronous timing motors has been released by Lux Clock Mfg Co, 95 Johnson Street, Waterbury, Conn.

• SELENIUM RECTIFIER REPLACEMENT: "Selenium Rectifier Replacement Guide", a 52-page booklet, gives detailed information on selenium rectifier replacement for many TV and radio chasses and other electronic products. Priced at $1.25, it is available from Federal Telephone & Radio Co, 100 Kingsland Road, Clifton, N. J., or one of its local distributors.

• CORD SETS: A 32-page catalog of its complete line of cord sets has been issued by Royal Electric Corp, a subsidiary of IT&T Corp, Pawtucket, R. I.

• BEARING LUBRICATION FITTING: A 4-page bulletin covers the Keystone RT fitting for bearing lubrication. Write Keystone Lubricating Co, 3100 N. 21st Street, Philadelphia 32, Pa. Ask for Bulletin BU-61.

• ELECTRICAL TESTING EQUIPMENT: A binder containing product information sheets, price lists and related information on its line of electrical testing equipment is available from HD Electric Co, 760 Osterman Ave, Deerfield, Ill.

• AIR CONDITIONERS: The following brochures are part of Airtemp's "Dial Springtime Anytime" series of product information folders. They are available from Airtemp Division, Chrysler Corp, 1600 Webster Street, Dayton 1, Ohio:

"Packaged" home air conditioners, 2 and 3-hp ratings, are covered in series "1100" folder, Form No. LL-149.

"Waterless" central-type home air conditioners are described in series "1200" folder, Form No. LL-150.

Commercial air conditioning, both water-cooled and waterless are covered in Forms No. LL-241 and No. LL-243.

• INCANDESCENT LIGHTING: An Incandescent Lighting Guide Book for commercial, residential and industrial lamp users covers more than 1,800 types and sizes of incandescent lamps manufactured by Sylvania Electric Products Inc, 1800 Main Street, Buffalo, N. Y.

• COMPENSATING LEVEL RECORDER: Bailey Product Specification No. M31-2 describes the company's compensating level recorder for drum level measurements in boiler operation. Write Bailey Meter Co, 1050 Ivanhoe Road, Cleveland 10, Ohio.

• CONDENSER TUBE PROTECTORS: How A-C stainless steel clip-on tube protectors provide safeguards for condenser tubes from the eroding impact of fast flying water droplets is told in Bulletin 19B8590, available from Allis-Chalmers Mfg Co, Milwaukee 1, Wis.

• POWER PLANT FIRE PROTECTION: Planning of fire protection for structures and equipment associated with power generation and transmission is aided by a 12-page bulletin available from "Automatic" Sprinkler Corp of America, Youngstown 1, Ohio.

KEES

SOCKET METER COVER

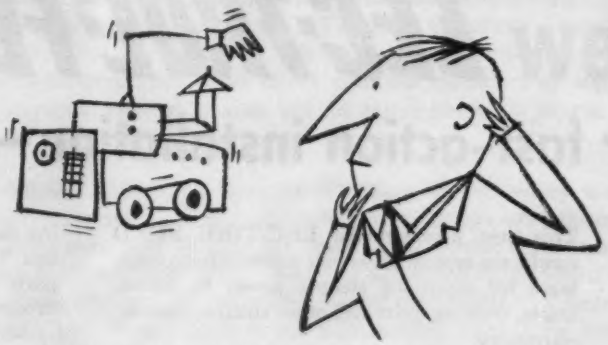
Fits all standard "S" Type meters

Made from 16 gauge zinc-coated, rust resistant steel and finished in gray baked-on enamel, the KEES Socket Meter Cover is designed to prevent breakage of glass on socket meters and to insure long service in any climate. Outside diam.—8" and depth—5⅝" and over. Metal cover is also reported to minimize damage from excessive current surge due to electrical storms.

Write P. O. Box 658 for Free Electrical Catalogue

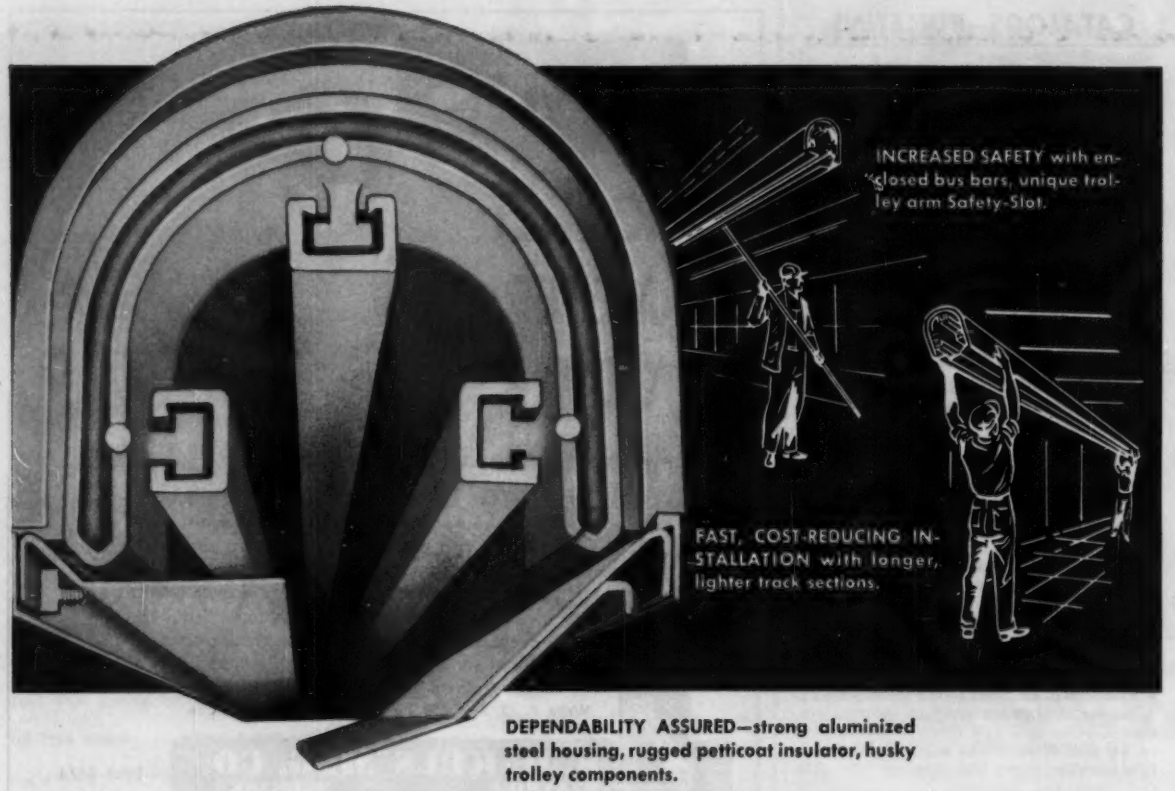
F. D. KEES MFG. CO.
BEATRICE NEBRASKA

Since 1874



What's a "Whatsamatron"?

We don't know—but if you've developed one lately . . . or come up with anything else new in products, procedures, new literature, research results, or what have you . . . why not give us the word. We'd like to hear all about it . . . and so would ELECTRICAL WORLD'S readers. Maybe you've expanded into new facilities, consolidated, shifted executive personnel, or maybe you've got product design or financial news. Whatever it is WORLD can bring it to the attention of the entire electric power industry. Like to know how? Just send for our booklet *"How to Get Maximum Value Out of the News Releases You Write for Electrical World."*


INCREASED SAFETY with enclosed bus bars, unique trolley arm Safety-Slot.
FAST, COST-REDUCING INSTALLATION with longer, lighter track sections.

DEPENDABILITY ASSURED—strong aluminized steel housing, rugged petticoat insulator, husky trolley components.

New *LEC-TROL-FEED* System

for fast-action installation—safety-first power

This new, preassembled LEC-TROL-FEED conductor system gives you outstanding advantages for supplying electric power to cranes, hoists, welding units and other straight-runway equipment.

LEC-TROL-FEED Systems are installed faster and at lower cost than ever before. All units are preassembled in standard 30 ft. rigid-track sections. That means fewer joints, fewer hangers. Expansion sections are needed only at building joints. No extra rain shields needed for outdoor applications.

You gain maximum safety with LEC-TROL-FEED Systems because current carrying bus bars are almost completely enclosed—minimizing danger from contact with current-carrying bus. Trolley Safety-Slot covers are removable—parts easily accessible. Rugged trolley—can be dropped out every 30 feet.

Additional features include compactness for close vertical stacking, maximum ruggedness, maximum leakage distances, proved aluminum bus bars. Track power capacity 300 amperes, AC or DC; trolley ratings up to 300 amperes.

For complete information,
write or ask for LEC-TROL-FEED Bulletin.
Electric Service Works,
Delta-Star Electric Division,
H. K. Porter Company, Inc.,
Philadelphia 32, Pa.

HKP

ELECTRIC SERVICE WORKS
DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

Divisions of H. K. Porter Company, Inc. are: Connors Steel, Delta-Star Electric, Henry Disston, Laclede-Christy, Leschen Wire Rope, McLain Fire Brick, Quaker Rubber, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings

ELECTRICAL BUSINESS OUTLOOK

Electrical World
APRIL 1, 1957

What's going to happen to interest rates for long-term funds? The way the money market is shaping up now it looks as though there won't be much change in rates this year. And it also looks as though no major business expansion programs will be blocked for lack of funds—provided borrowers are willing to pay today's high rates.

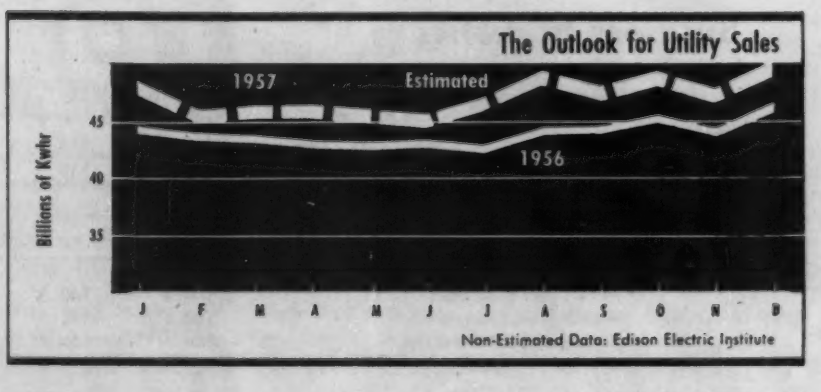
Some basic changes are taking place in the money market. Last year the demand for new funds for mortgages, corporate and foreign financing, and state, municipal and public revenue financing rose to $27.1 billion. But the supply for funds rose only $21.8 billion, leaving a net deficiency of $5.7 billion to be made up by the banking system.

Demand for long term funds will rise much less this year, probably about $23.2 billion, according to estimates by Girard Spencer of Salomon Bros. & Hutzler. And, because of the normal growth of financial institutions, the supply of funds will run larger this year, probably about $22.1 billion. This leaves a deficiency of $1.1 billion for the banking system to make up. A $3 billion drop in the net requirements for mortgage, loans, caused in large part by fewer housing starts this year, explains most of the lag in demand for new funds.

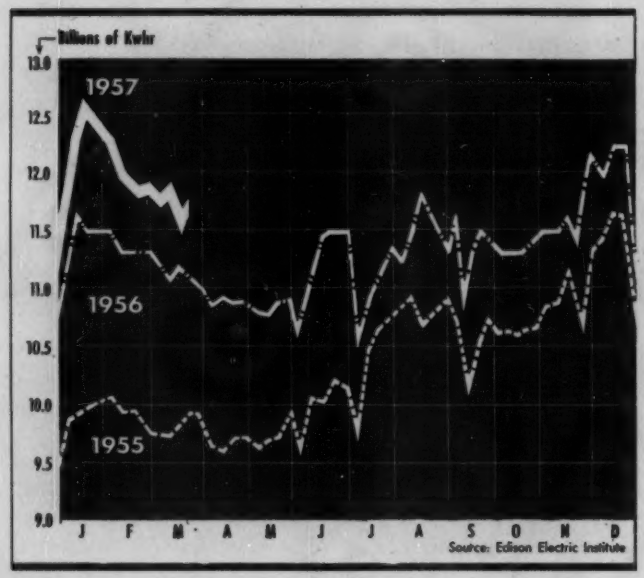
A surge in the demand for funds, though entirely possible, does not appear to be in the making. And the fairly close balance between the supply and the demand now suggests that interest rates should hold fairly close to their present levels for the rest of the year.

For electric utilities this doesn't promise much relief from interest rates running between 4 and 4½% on high grade bonds. That's not an entirely happy prospect for a year in which private utilities will be investing close to $4 billion in capital improvement programs. And recent estimates indicate they will turn to the long-term capital markets for over half the money needed to finance these plans.

But there is a bright side. The changing conditions in the money markets have made them very receptive to new equity issues. Common stock floatations by electric utilities were larger during the first quarter of this year than they were for the entire 12 months of 1956. And they accounted for one-third of all the long term funds obtained by the utilities during the quarter. A large part of the new issues have been offered to old stockholders through the issuance of rights. This may become a pattern in utility financing this year.



STATISTICS



OUTPUT
Week ended March 23, 11,723,000,000 Kwhr Up 5.3%

Per Cent Change From Previous Year

	Mar. 9	Mar. 16	Mar.23
Total U. S.	+ 3.3	+4.0	+ 5.3
New Eng.	+ 4.0	+1.1	+ 4.0
Mid. Atlan.	+ 7.1	+0.0	+ 2.1
Cent. Ind.	+ 9.7	+4.0	+ 4.9
West Cent.	+10.8	+7.0	+ 8.3
Southeast	+10.3	+5.2	+ 4.9
South Cent.	+ 7.0	+9.4	+12.5
Rocky Mount.	− 4.7	+5.9	+ 8.1
Pacific			
NW	+ 4.2	+0.5	+ 4.7
SW	+ 6.6	+5.4	+ 5.5

Seasonally Adjusted Index 225.8
Week Ago 223.5
Year Ago 215.1

Atomic Energy Commission requirements—1,150,000,000 Kwhr (Electrical World estimate.) Excluding AEC, output increase was 5.6%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Jan.	121.20	120.43	114.55	5.8
Peak—Class 1 Systems. million kw	Dec.	102.8	101.2	98.3	4.6
Estimated Dec. '57 Peak	Dec.	114.5	114.8	112.6	1.7
Production—billion kwhr	Jan.	55.50	52.88	51.12	8.6
Hydro		10.19	10.00	9.36	8.9
Fuel		45.31	42.88	41.76	8.5
Sales—billion kwhr	Dec.	47.46	45.78	45.15	5.1
Residential		13.22	11.66	12.31	7.4
Commercial		7.34	7.20	6.80	7.9
Industrial		24.44	24.51	23.70	3.1
Other		2.47	2.41	2.33	6.0
Fuel Consumption	Jan.				
Coal—million tons		15.98	14.73	15.22	4.9
Oil—million barrels		9.90	8.22	8.22	20.4
Gas—million cu ft		74.77	82.17	68.27	9.5
Net Income Class A & B Co's— million	Dec.	132.82	102.54	124.95	6.3
Residential Customers—millions	12 mos.	45.71	45.62	44.41	2.9
Revenue per kwhr	ended	2.60¢	2.60¢	2.64¢	−1.5
Avg kwhr per customer	Dec. 31	2,969	2,942	2,751	7.9
Avg annual bill		$77.19	$76.86	$72.63	6.3

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Feb.	146	146	143	2.1
ENR Construction Cost	Mar.	148.6	148.9	142.6	4.2
BLS Cost-of-living	Feb.	118.7	118.2	114.6	3.6
New Orders for Machinery (1950 = 100)	Jan.	152	138	135	12.6
NEMA Sales					
Insulation materials	Jan.	154	139	159	−3.1
Electric appliances		96	84	105	−8.6
Wholesale prices	Jan				
Motors and generators		140.2	140.6	126.5	10.8
Transformers and regulators		146.6	146.6	131.2	11.7
Switchgear and fuses		164.4	163.9	147.5	11.5
GNP—annual rate—$ billion	4th Qtr.	423.8	413.8	397.3	6.7

MANAGEMENT BULLETIN

FINANCE

With American Telephone & Telegraph Co taking the spotlight last week as it floated a $250 million debenture issue, only two electric utility companies offered securities. The first was Black Hills Power & Light Co offering of 34,377 common shares through rights on a 1-for-8 basis, record March 22 to expire April 9 at $22 a share. There is an oversubscription privilege. . . . As EW was going to press, New Orleans Public Service Co was getting ready to accept bids on $6 million first mtg bonds due 1987.

Eastern Utilities Associates' stockholders are getting rights to subscribe to 89,332 common shares on 1-for-12 basis, record March 20 to expire April 4 at $30.50 a share. Kidder, Peabody & Co is underwriting the issue at 27¢ a share.

Other rights offerings are going well. Consolidated Edison Co of New York stockholders subscribed to 96% of the $54,827,500 convertible debentures recently offered . . . Stockholders of West Penn Electric Co took up 97.7% of 528,000 common shares. Balance of 11,964 shares was purchased by an underwriting group . . . Connecticut Light & Power Co stockholders subscribed to 892,652 of 927,598 common shares on 1-for-7 basis at $16.50. Management recommends unsubscribed shares be offered to employees at $16.50.

Electric utilities plan to do at least 50% more financing in 1957 than a year ago, Irving Trust Co has announced. With only 75% of electric companies reporting their programs, expected sales already total $2.2 billion as compared with $1.4 billion in all of 1956.

Second quarter looks busy for new security offerings. Electric companies have already scheduled $470 million, Irving Trust Co says.

Southern California Edison Co will require about $180 million in new money in the 1957-58 period, Pres Harold Quinton told New York Society of Security Analysts. Company is planning to spend $300 million for construction in this period.

Minnesota Power & Light Co gets Federal Power Commission approval to sell privately $12 million first mtg 4¾% bonds at 101.7599% to Shields & Co and Equitable Securities Corp.

Tennessee Valley Authority financing bills are scheduled for hearing on March 28 in the Subcommittee on Flood Control of the House Public Works Committee.

LABOR

Kentucky Utilities Co and Kentucky Research Foundation establish "D. V. Terrell Fund for Engineering" at the University of Kentucky. Named after Engineering Dean D. V. Terrell, fund will be used to supplement salaries of College of Engineering faculty members "so that outstanding men may be retained and others may be attracted."

Douglas Electric Cooperative has just published a 26-page booklet entitled "Organization and Job Descriptions." It contains a 3-page preface, 4 pages of organizational charts, and 19 pages of job descriptions. For copy, write Manager Harold Backen, Roseburg, Ore.

Jersey Central Power & Light Co and New Jersey Power & Light Co put in educational assistance program for their employees. Course must pertain to company operations. Classes or lectures must be conducted after working hours. Upon satisfactory completion of course, company will refund to the employees 75% of the tuition fee paid by him.

How may engineering schools find and keep good engineering teachers to help develop new talent and knowledge. American Society for Engineering Education, of which Georgia Institute of Technology is an institutional member, will

conduct a survey to find the answers. Survey will cover three areas:
1. To survey what is known and to develop additional information required to measure quantitatively the need for new engineering teachers.
2. To identify and study the problems to be solved in meeting this need—the financial problem, the conditions required to make college teaching competitive with other engineering careers, the unique satisfactions and rewards of the teaching profession.
3. To initiate and encourage activities—based on the program's findings—to increase the supply and quality of engineering teachers.

Engineering students are on the increase. Recent report of the Office of Education of Engineers Joint Council shows that 72,825 were enrolled for engineering degrees in the first year in 1955-1956 as compared with 77,738 in 1956-1957. Office of Education estimates that "only 57% of those who enter engineering courses complete them and obtain the bachelor's degree." Applying this formula to this year's freshmen class (77,738), Office of Education expects graduations to reach 44,000 in June 1960—if there is no deterioration in the quality of entering students.

Columbus & Southern Ohio Electric Co and IBEW agree to 5.9% wage increase. This agreement was reached after meeting with Commissioner George H. Bell of the Federal Mediation and Conciliation Service.

TAXES

Washington state legislature passes bill increasing to 20% (from 10%) the state surtax on public utilities . . . A bill for a 37% increase in state income tax has been approved by the Idaho legislature . . . Oregon House has a bill which will increase corporation excise tax rate from 4% to 8%.

PUBLIC RELATIONS

An article "The Hidden Cost of Public Power" by Ira U. Cobleigh and Robert A. Gilbert has been published in the "National Review" magazine of March 16. It deals with the building of the 812,000-kw plant by Memphis, Tenn. Reprints can be obtained from National Review, 211 East 37th Street, New York 16, at 15¢ each or 100 copies for $10.00.

Utility customers are invited to a gripe session. New England Telephone & Telegraph Co subscribers in Bartlett and Jackson, N. H., were welcomed to a sort of Telephone Town Meeting. It was held so that customers could "get criticisms off their chests."

"We Worry—Do YOU?" is a booklet put out by NEGEA Customer News. It contains a message about federal power. For copy, write New England Gas & Electric Association, 727 Massachusetts Ave, Cambridge 39, Mass.

ANNUAL REPORTS

We're impressed with the generally high quality of reports coming to our desk. If you're looking for some sparkling ideas: Look at the two-color map spread in Rockland Light and Power Co's 1956 report. . . . Or the three-color, fold-out map in Interstate Power Co's report. . . . Or the cleanly illustrated map shown in Cleveland Electric Illuminating's report. . . . Statistical charts on high gloss paper in the Mississippi Power Co report are a real joy to see. . . . California Electric Power Co pays tribute to the engineers' contribution with a reflective cover photograph. . . . The two-color charts in Otter Tail Power Co's and California-Pacific Utilities Co's reports are clear and tell the story at a glance. . . . Commonwealth Edison Co uses the "Little Bill" symbol, representing the bargain of electric service, for its cover piece. . . . Indianapolis Power & Light Co devotes its center spread to photos of recent building additions in its service area under heading "There's Progress in Indianapolis." It gets a lot out of its two-color charts.

Hi-Voltage–Joslyn Markets Vacuum Interrupter Switch

The Hi-Voltage Equipment Division of Joslyn Mfg & Supply Co has introduced a line of vacuum switches ranging from 7.5 kv through 230 kv.

Design of these switches is predicated on experience of more than one year of switching capacitor banks, stated a company spokesman. Specifically, test installations have been in service in various climates ranging from the extreme temperatures of the plains of Oklahoma to the severe winter conditions of the Cleveland area. Installations have included capacitor banks ranging in sizes up to 5,000 kvar. In no case, it is reported, has a failure of a switch occurred.

In each voltage rating the vacuum switching equipment consists of a conventional gang-operated disconnect switch equipped with the Hi-Voltage-Joslyn Type I vacuum interrupter unit. A gang switch equipped with this interrupter unit is reported to be capable of interrupting a power system load ranging from zero power factor through the leading power factor range to 0.85 pf lag with current values from zero to 2,500 amp depending upon how many operations are desired.

Since the vacuum interrupter element is completely by-passed in the closed position of the gang switch, the entire installation has the same continuous and momentary current ratings as does a conventional gang switch.

Seen in the picture is Joseph D. Hoffman, Division vice president of Joslyn Mfg & Supply Co, viewing a 15-kv, vacuum switch with interrupting rating up to 600 amp for a grounded-wye capacitor bank.

Line Material to Market 200 Mva OC Recloser

A 200-Mva, 3-phase, oil circuit recloser is ready to be marketed by Line Material Industries, Milwaukee, Wis. Reportedly the largest self-contained interrupter offered to the electric industry, this recloser is applicable in substations or on heavily loaded feeders where high fault currents may be expected.

Designated Type W, it is rated 560 amp maximum continuous and is applicable on 2.4 through 14.4 kv systems. Reduced trip ratings are said to make the recloser applicable in installations that require sensitivity to lower fault currents but not high capability for coldload pickup.

First opening time is 2.5 cycles maximum. This feature offers protection to bare and weather proof conductors, enables economical increase in substation capacity, and permits improvement in source-side fusing.

Reclosing time is 120 cycles and can be adjusted to 25 cycles. Accessories facilitate application for remote control and load transfer schemes, and for sensing of phase current balance.

A-C Awarded Record Order for Hydroturbines

The largest order for hydraulic turbines ever received by Allis-Chalmers Mfg Co was placed by U. S. Army Corps of Engineers. The turbine contract is in excess of $10 million and includes seven units for installation in the Oahe Reservoir project on the Missouri River near Pierre, S. D. Each turbine will be rated 128,500 hp under 185-ft head.

The first hydraulic unit is scheduled to be shipped in the spring of 1960. Remaining units are to be supplied at about 3½ month intervals. Completion is set for the fall of 1962.

This Oahe installation will be the third Missouri River project for which A-C hydraulic turbines are supplied. At present the company is building two 63,500-hp hydraulic units for the Ft. Peck dam in Montana. Previously A-C built and installed eight hydraulic turbines, each rated 57,500 hp, for the Corps of Engineers' Ft. Randall reservoir in South Dakota.

U. S. Copper Production

U. S. primary copper production for February totaled 92,242 tons, according to the Copper Institute, New York. This amount was more

(Continued on page 98)

"Call the museum, Joe; I think we're uprating a real antique!"

Your General Electric Apparatus Service Shop can rebuild your old transformers like new. The shop can uprate your old transformers in both kva and voltage for about two-thirds the cost of new transformers . . . can also convert to self-protected type. And you get new-transformer warranties. Call your G-E Apparatus Service Shop or Sales Office. 431-56

Progress Is Our Most Important Product

GENERAL ELECTRIC

Portable Exhibit Shows Pinco Insulators as . . .

Color Movie Tells Story of Porcelain

Porcelain Insulator Corp is launching today a promotion program highlighted by a new full-color motion picture, "Guardians of Power."

The 25-min, 16-mm sound presentation portrays from start to finish the operations in Pinco's plant at Lima, N. Y. The documentary-type film tells a factual story of the techniques employed in the manufacture of electrical wet process porcelain.

The film will be made available to electric utilities as well as to engineering schools, societies and other interested audiences. Presentations can be arranged by writing Leo B. Harvey, president, at Lima, N. Y.

U. S. Copper Production

(*Continued from page* 97)

than 2,600 tons short of the quantity produced in January. Refined copper production was 134,119 tons in February, compared to 139,150 tons for the preceding month. Deliveries to fabricators totaled 101,565 tons for February, almost 18,400 tons less than for January. Refined stocks at the end of February was 136,330 tons, an increase of 17,766 tons over the 118,564 tons at the end of January.

Work Simplification Saves $213,000 for AMF

Working "smarter" instead of "harder" will save American Machine & Foundry Co an estimated $213,000 annually as a result of the company's 1956 Work Simplification program, it was reported by Clark C. Sorensen, AMF's director of public and industrial relations.

These savings reflect the efforts of only six of AMF's 37 plants, and these six have had the program operating for about five months. The program will be extended to other AMF plants during 1957.

The savings represent an average of nearly $5,000 per accepted proposal. With 78 other proposals under consideration, the total could reach $500,000 in annual savings.

To Produce Titanium

Kennecott Copper Corp and Allied Chemical & Dye Corp have formed Allied-Kennecott Titanium Corp to produce and sell titanium, it was announced recently. The new company will produce titanium chloride, titanium sponge and titanium billets. Operations are expected to begin late in 1958. Several locations are being considered as a site for the company's plant, and a decision will be expected shortly.

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA
STEEL & WIRE CO., INC., Muncie, Indiana

Westinghouse Erecting Athens Transformer Plant

A multi-million dollar distribution transformer plant is being constructed for Westinghouse Electric Corp at Athens, Ga. When the new plant is in full production, it will reportedly double the company's present capacity for producing distribution transformers.

The plant will be located on a 238-acre site. The one-story structure will have about 750,000 sq ft of floor area.

Gwilyn A. Price, chairman and president of Westinghouse, at the ground breaking ceremony said "Generating capacity in eight southeastern states has been doubling about every five years while nationally the time span has been nine to 10 years". He predicted a $2 billion sales year for the company. He termed the Athens plant one of two major expansion programs getting underway this year.

M & M BRIEFS

Union Carbide Corp is the proposed name for Union Carbide & Carbon Corp, New York. If approved by the stockholders at the annual meeting on April 16, the effective date of the change will be May 1.

H. K. Porter Company, Inc, is constructing a 16-story office building in Pittsburgh. General offices of the company will occupy four floors and other floors will be rented. Occupancy is expected in May, 1958.

General Electric Co's switchgear division has reportedly effected a considerable reduction in container costs resulting from changes in packaging for its line of low-voltage air circuit breakers. Prior to the changeover, the circuit breakers were packaged in rigid containers. The new container is a heavy corrugated box manufactured by Union Bag-Camp Paper Corp.

Cutler-Hammer, Inc, Milwaukee, Wis., is reported having selected a site for a new manufacturing plant costing more than $4 million at Lincoln, Ill.

CURRENT TRANSFORMER FIELD TEST SET

NEW!

Check your current transformer installation quickly with this NEW TESCO instrument; pinpoint sources of possible trouble in short-circuiting, faulty connections, instrument tampering, and grounding.

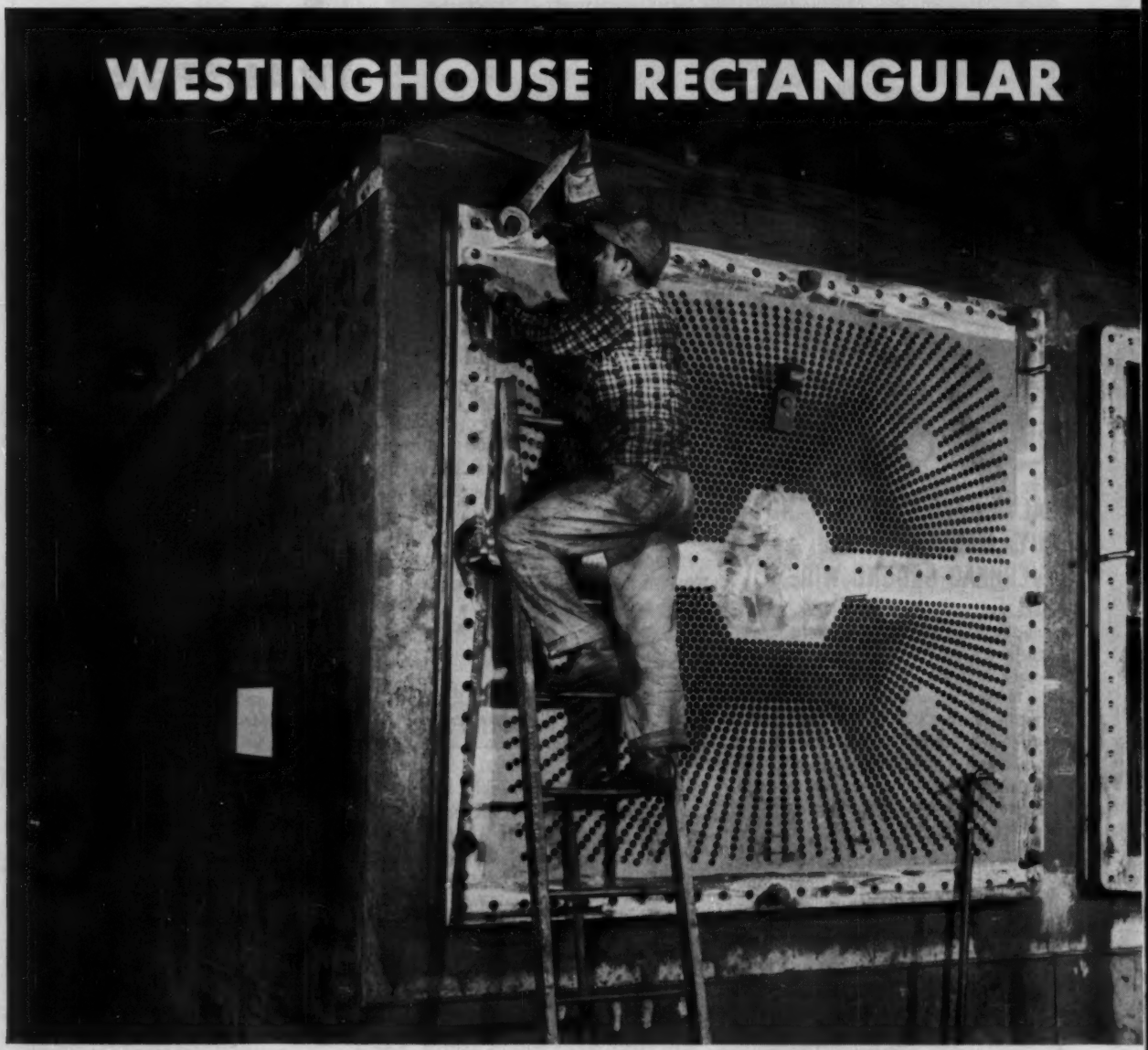
A special new feature now available in this instrument is the spread of resistance burdens — .5, 1, 2 or 4 ohms. The lower burden values are recorded for testing the small size low capacity current transformers, which are widely used on low voltage installations.

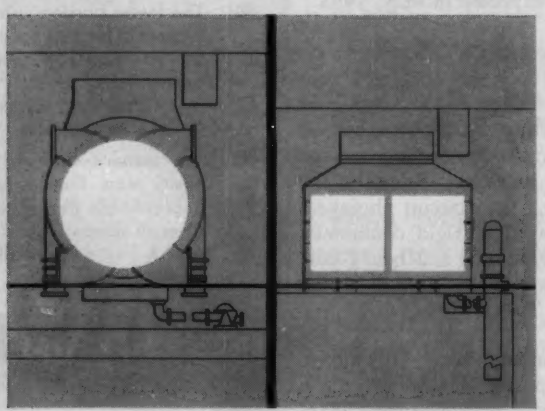
2½" panel instrument is easily read. Transparent unbreakable plastic cover. Overall dimensions 6⅞" x 5¼" x 3⅛" high. Weight 2¾ pounds.

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

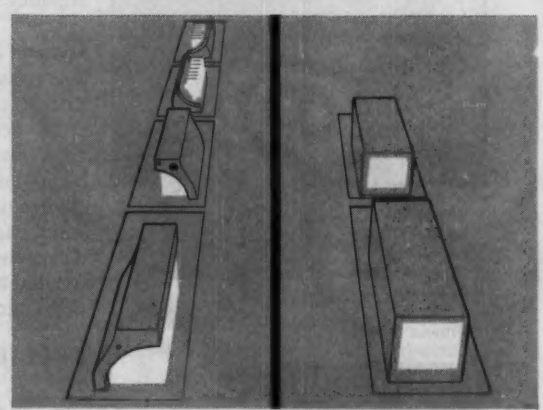
For full information, write for Bulletin No. 54-B

WESTINGHOUSE RECTANGULAR





Waste no space! Rectangular condensers require less headroom, fully utilize all space under turbine.



Faster installation! Rectangular condensers can be shipped in "bigger chunks" . . . less field welding.

...another great timesaver for station erection schedules

SAVE TIME—Basic simplicity of rectangular condenser design makes it possible to ship "bigger chunks of capacity." Building-block assembly speeds rigging; field welding is drastically cut. With its flat base, it is quickly and easily leveled. Westinghouse rectangular condensers can get you on the line faster.

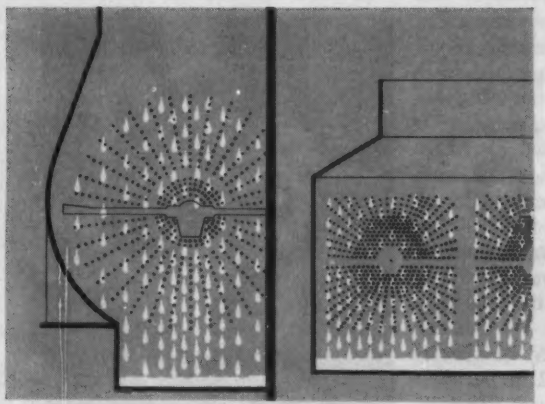
SAVE SPACE—As station ratings go higher and higher, equipment gets bigger. That's when space utilization takes on increasing importance. Westinghouse rectangular condenser design uses *all* the space under the turbine—*wastes none.*

BOOST EFFICIENCY—Two things, above all, you want from a condenser: Lowest possible absolute pressure, maximum reheating and deaeration of condensate. With its two-compartment radial-flow design and consequent short steam path to center air offtakes, a rectangular condenser provides lowest pressure drop. Uniform fall of condensate and the counterflow of steam from the lower steam belt liberate oxygen and assure deaerated condensate at saturation temperature.

Get the full story on Westinghouse condensers, circulating pumps, condensate pumps and air ejectors from your Westinghouse representative; or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-50595

YOU CAN BE **SURE**...IF IT'S

Westinghouse



Boost efficiency! Lowest pressure with maximum reheat; condensate falls uniformly through belt of steam.

EARL J. ARCHBOLD

EDGAR S. HARRISON

Georgia Power Appoints Two to Engineering Positions

Georgia Power Co has announced the promotions of Earl J. Archbold to the position of chief electrical engineer and of Edgar S. Harrison to chief mechanical and hydraulic engineer of the utility.

Archbold has been serving as assistant chief electrical engineer since August, 1953. A 30-year veteran with the utility, he came to Georgia Power in 1927 as a draftsman and advanced to positions of increasing responsibility, including electrical engineer and general design engineer. Archbold is a graduate of Purdue University and holds a degree of bachelor of science in electrical engineering.

Harrison, who has been with Georgia Power since 1939, has been assistant chief mechanical engineer since 1953 and previously served as hydraulic engineer. Before his association with Georgia Power, he was employed by the Tennessee Electric Power Co. Harrison was graduated from Georgia Institute of Technology with the degree of bachelor of science in civil engineering and has served as president of the Georgia section of American Society of Civil Engineers and as vice chairman of the hydraulic power committee of the Edison Electric Institute.

In addition to these promotions, Hugh B. Hutchins has been advanced to the position of assistant chief electrical engineer to succeed Archbold, and R. S. Albright was appointed assistant chief mechanical and hydraulic engineer.

Hutchins, who holds a bachelor of science degree in electrical engineering from Georgia Tech, has served as senior engineer since September, 1956. He has been with Georgia Power since 1939, when he started as a draftsman.

Albright has served as a senior engineer at Georgia Power since March, 1956. He is a Georgia Tech graduate with a degree in mechanical engineering and started with Georgia Power Co 17 years ago as a draftsman.

General Nuclear Engineering Elects West VP

Newly appointed vice president of General Nuclear Engineering Corp is John M. West, former associate director of Argonne National Laboratory's Reactor Engineering Division and project manager of the laboratory's 5,000-kw nuclear power plant.

West, who has spent most of his career in atomic energy, is a 1939 graduate of Northeastern Oklahoma State College and received his M.S. in physics at Iowa State University in 1941. After graduation, he was assigned to atomic energy work with E. I. du Pont de Nemours & Co in conjunction with a Manhattan Engineer District project. In 1943-44 he participated in early experiments with the world's first nuclear reactor at University of Chicago's Metallurgical Lab. For the next five years he was with Hanford Engineer Works where he participated in the startup, operation, and evaluation of the performance of reactors.

He joined Argonne in 1949 with responsibility for detailed design of the Argonne heavy-water moderated research reactor. In 1952 he became head of Reactor Engineering Division's planning section. He was 1954-55 chairman, National Reactor Evaluation Committee.

JOHN M. WEST

Florida Power Ups Herron

A. C. Herron, former manager of Florida Power Corp's plant and depreciation accounting division, has been named purchasing agent to succeed Howard Letzring who has resigned.

During his 32 years with the utility, Herron also has served as traveling auditor, cost accountant, and assistant auditor. He is chairman of Edison Electric Institute's plant accounting and property records committee.

Leonard A. Gould, who will assume Herron's former post, previously served as senior engineer in the division.

Wylie Assumes Marketing Post

Sangamo Electric Co has named R. R. Wylie to the new post of marketing manager. He will be in charge of advertising, sales promotion, and market research.

Wylie, former manager of Sangamo Meter & Power Capacitor Department of Rumsey Electric Co, assumes the new post with full cooperation of the latter firm, a Sangamo distributor.

As marketing manager he will be assisted by T. N. Teigen, advertising department manager. Kenneth A. Goebel succeeds Wylie as manager of Sangamo sales for Rumsey.

PERSONAL BRIEFS

Howard G. Lasselle has been appointed distribution engineer for New England Electric System, succeeding **Wendell Phillips,** retired.

Winner of American Institute of Electrical Engineers' 1956 Lamme Gold Medal is **Dr Harold H. Beverage,** vice president of RCA Communications, Inc, and director of radio research laboratory, RCA Laboratories.

Pacific Power & Light Co's **Leonard Bennett** has been elevated to assistant vice president to assist **Pres Paul B. McKee** and **D. R. McClung,** executive vice president. He will also act as coordinator for officers and department heads in Portland. In other company promotions, **R. R. Gordon** was made Kalispell district manager; **J. Stanley,** Tillamook district manager; and **Richard Gosney,** Toppenish local manager.

At Virginia Electric & Power Co, **Mrs. Alice Patricia Faulconer** is new home economist in the Fredericksburg area; **William E. Kitchen** has been named rural representative to serve the Warsaw area; and **Sterling W. Matthews** has become Blue Ridge district engineer.

William B. O'Rourke has been named acting manager of Colorado Rural Electric Assn to replace **H. Vance Austin** who resigned recently . . . Rural Electrification Administration has appointed **Charles W. Fitch** to succeed the late **Robert S. Broderick** as head of operations section 1 in the Northeast area electric program.

General Electric Co's Lamp Division has designated **Roy L. Johnson** as acting manager of its recently reorganized warehousing and field service section. Under the new set-up, the nation has been divided into six new service regions with the following managers: **Robert G. Weiland,** Western service region, with headquarters in Oakland, Calif.; **George A. LeRuez,** Central, Chicago, Ill.; **Harlan E. Lindberg,** Midwestern, St. Louis; **Harry P. Thatcher,** East Central, Cleveland, Ohio; **John A. Amport,** Eastern, New York City; and **Alex C. Ham,** Southern, Atlanta, Ga. In other promotions, **John J. Gates** became New York service district manager; **William P. Duff,** Chicago service district manager; **Darrel D. Lingle,** Dallas service district manager; and **Nelson E. Varnum,** Newark (N. J.) service district manager. **James B. DeArment** is new manager of the recently established warehousing and transportation sub-section.

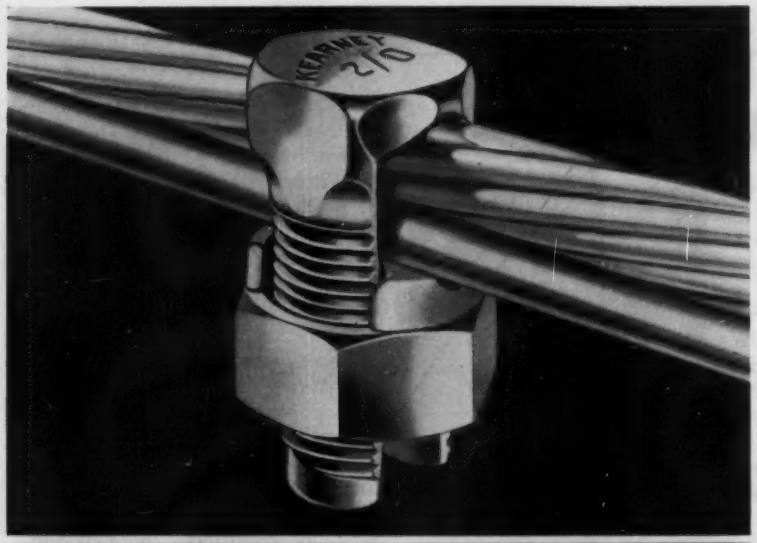
OBITUARY

George E. Duerr, 54, general sales manager for West Penn Power Co since 1954, died suddenly.

D. C. Tinker, 59, vice president of distribution and commercial manager of Western Light & Telephone Co, Inc, and **William A. Fowler,** 59, manager of the company's Southern Division, were killed in an automobile accident last month.

Percy H. Thomas, 84, retired electrical engineer who served with the office of the chief engineer of Federal Power Commission from 1934 to 1948, died recently.

Robert W. Wilson, 60, manager of commercial business promotion and development for Kentucky Utilities Co, died recently in Lexington, Ky.

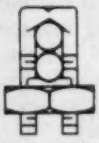


KEARNEY
CON-NEC-TITES

the service-proved
split bolt connectors

Thirty-one years ago, KEARNEY perfected Con-nec-tites . . . first of all split bolt connectors. Since that time, KEARNEY engineering has continued to pioneer in the development and improvement of a complete variety of service-proved connectors for every distribution requirement.

KEARNEY all-purpose Con-nec-tites are easy to install, and provide high conductivity connections. Fully plated with uniform, non-peeling, tightly bonded coating that makes harmonious contact with either aluminum or copper without destructive galvanic action.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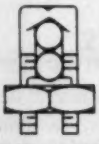
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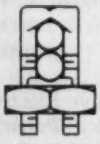
COPPER TO COPPER

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SAFER MAINTENANCE
Specify KEARNEY PRODUCTS
Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA.—GUELPH, ONT., CAN.

SALES ASSIGNMENTS

COMPANY STAFFS

Babcock & Wilcox Co's Tubular Products Division has appointed William Lehr manager of its new district sales office in Atlanta, Ga. The area served by the new office includes Georgia, South Carolina, North Carolina, Alabama, Florida, and the southeastern section of Tennessee.

Chase Brass & Copper Co, a subsidiary of Kennecott Copper Corp, has advanced G. C. Van Heusden to district manager of the new New York warehouse and office. He succeeds Herbert H. Bartlett who retired recently.

Gould-National Batteries, Inc, has named Lewis L. May, Jr, as Gulf Regional manager of the Industrial Division, with headquarters at Dallas, Tex. The region comprises Texas, Louisiana, Mississippi, western Tennessee, and southwestern Alabama.

Malleable Iron Fittings Co's Pole Hardware Division has designated Glenn D. Slaybaugh and William F. Thompson as sales representatives for the states of Colorado, Utah, and portions of Wyoming.

Minnesota Mining & Manufacturing Co has appointed Alvin C. Kilberg as industrial trades sales manager of the Electrical Products Division.

Motorola, Inc, has promoted Walter C. Byrne, Jr, to sales manager in its microwave and industrial control department.

Research-Cottrell, Inc, has named Hugh D. O'Rourke as district sales manager for its Chicago office.

Simplex Wire & Cable Co's E. F. Galvin is new district manager for New England. The company also announced the March 29 retirement of Arthur W. Coombs, who served as New England sales manager since 1946.

Sylvania Electric Products, Inc, has designated Carl S. Long, Jr, as new Denver district sales manager, Lighting Division. He replaces Bill Lounsbury, who moved on to Kansas City as district sales manager.

REPRESENTATIVES

Philco Corp's Government and Industrial Division has appointed Exec-U-Phone Systems, Inc, of Boston, Mass., to represent it in the sales and servicing of its paging equipment and industrial television systems in New England.

Pittsburgh Reflector Co has announced that David S. Young Co will cover the Mid-Gulf area from New Orleans.

Sorenson & Co, Inc, has appointed Pivan Engineering Co as its representative in Illinois, Indiana, Wisconsin, and Eastern Iowa.

Coal Firms Sue UMW For Loss of TVA Contract

Two coal firms have added $1.3 million in punitive damage claims to their $11-million suits against United Mine Workers now pending before a U. S. district court.

The suits claim that union-inspired coalfield violence in 1955 caused the firms—Osborne Mining Co of Kentucky and Love & Amos Coal Co of Nashville—to lose a contract to supply 6,325 tons per week to Tennessee Valley Authority's Kingston plant.

The plaintiffs contend that when Love & Amos sublet part of its contract to the Osborne firm, which employed non-union labor, UMW insisted that Osborne recognize the union as bargaining agent. This was refused.

As a consequence, the suits state, the unions began an organizing drive under leaders "peculiarly experienced in the art of organizing and controlling mobs." The resulting violence cut down on production to the extent that Love & Amos lost its contract, the plaintiffs contend.

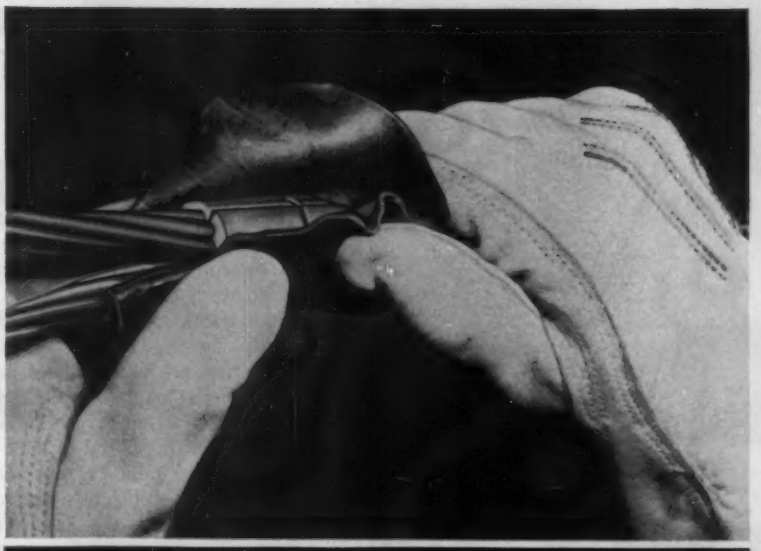
More Construction

Utilities continue to plan ahead. Latest construction plans include a 350,000-kw, $67-million plant which Union Electric will start in 1958, and Public Service E&G's projected 300,000-kw, $75-million generating station near Trenton (N.J.). Washington Water Power has a $20-million dam and hydroplant on the Spokane River in mind, with construction to start in five or six years.

Sporn Contract Let

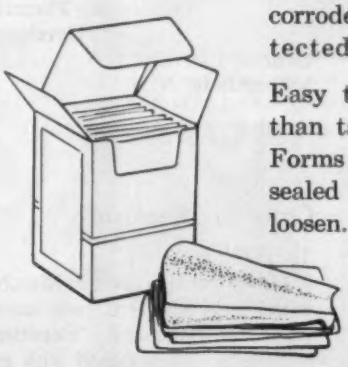
A contract has been awarded for general construction work on the installation of a new 450,000-kw steam-electric generating unit at the Philip Sporn Plant, Graham Station, W. Va.

Sporn Plant, with a present capacity of 600,000 kw, already is the largest on the seven-state American Gas & Electric System. It is owned jointly by Appalachian Electric Power Co and Ohio Power Co.



only KEARNEY AIRSEAL

applies so quickly... protects so completely!



Moisture, airborne contaminants, industrial fumes, or salt air *can't* corrode electrical connections protected by KEARNEY Airseal!

Easy to apply . . . takes less time than taping . . . lasts much longer. Forms a permanent, weather-tight sealed cover that won't dry out or loosen. Yet, if necessary, Airseal peels off cleanly . . . and never sticks to gloves or hands! Available in pads and rolls of various sizes.

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Plants at: ST. LOUIS • FAYETTEVILLE, ARK. • SHENANDOAH & CLARINDA, IA. — GUELPH, ONT., CAN.

WRITE FOR FREE SAMPLES

• Essential for Electrical Men

Another FIRST FOR THIEL IN THE NEW HUMP DRIVE NAIL-IT STRAP. THE HUMP HAS A STURDY HEAD TO INSURE EASY-DRIVE WITHOUT BENDING OR PULLING OUT. MADE OF #8 HEAVY WIRE. ZINC PLATING PREVENTS RUST.

COPPER PLATED FOR PLUMBER'S USE — AVAILABLE SOLD ONLY THRU LEADING ELECTRICAL WHOLESALERS.

THIEL TOOL & ENGINEERING CO., INC.
1417 N. MARKET ST. LOUIS 6, MO.

Two New Mineralloc Quality Products Designed for Jobs Too Heavy for Standard Jiffy Clips

MINERALLAC
Heavy Duty AND Medium
JIFFY CLIPS

Also available without mounting hole for use with gun.

patent pending

Made of heavier materials! Has exclusive inverted rib, that provides more strength at the bend of clip . . . and, of course, adds the benefits of famous "Snap On" feature!

In stock in Zinc-Plated Steel for Thin Wall or Rigid Conduit up to 6". (Hot Dipped Galvanized may be obtained on order) Can be substituted for malleable clips.

Order From Your Electrical Wholesaler

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MINERALLAC

READERS FORUM

Another Viewpoint

To the Editor:

In a Technical Note in the Nov. 12, 1956, issue you discuss ungrounded industrial distribution concluding ". . . its service record can be considerably better than a grounded system".

Such facts as we have indicate quite the opposite to be true. As you know, there are two kinds of industrial system grounding. Conventional, low resistance grounding is used where it is desired to have sufficient ground fault current to operate an overcurrent protective device to remove the faulty unit. High resistance grounding, on the contrary, does not clear a ground fault on equipment or a circuit but does limit the restriking voltage so that the system is not damaged and multiple failures do not occur.

Not incidentally we find practically all 13.8-kv and 4,160-v industrial distribution systems grounded and more 2,400-v systems following that trend. About half of the new 480-v systems are grounded, too. Would operators be adopting grounded in preference to ungrounded unless there were benefits in it for them?

D. L. Beeman
Manager, Indus Power Systems Engineering
Engineering Planning & Development
General Electric Co
Schenectady, N. Y.

Calls for Realism

To the Editor:

On page 83 of the March 11 issue, copy enclosed, you start off with the statement, "Experienced engineers have watched with growing dismay that starting salaries for engineering graduates have climbed higher and higher." I have no idea who did the editorializing on this particular news item, but I trust that you will agree that the quoted statement bears no resemblance to the actual truth. To me, the really amazing thing in this present situation is that starting salaries for engineering graduates have not risen to a much higher level than they now are. If the law of supply and demand were permitted to operate in this field, I am sure the story would be a much different one.

Most of similar discussions in the engineering press of today are filled with such misconceptions. No wonder that the limited supply of engineering talent continues as a serious problem in this country.

I have just completed 30 years with my present company. I find that the young engineers that we are employing have just as great a financial problem as I did when I started. I also have a son who is in this supposedly highly enviable position of a recent engineering graduate. In spite of these "fantastically high starting salaries" that you and hundreds of other industry writers refer to, his financial problems are probably more serious than mine were some 30 years ago. The point of the whole situation, which you all unanimously ignore, is that $500 per month per month today doesn't buy any more than $200 did 30 years ago. After federal and state income taxes are deducted, the problem of shopping for housing, food, clothing, etc., with 45-cent dollars is a very tight one.

If we are going to continue to give recognizedly serious situation wide magazine coverage, please let's discuss it with a little realism. Possibly something constructive might come out of it.

L. C. Twichell
Assistant Manager
Commercial & Industrial Sales Dept.
Rochester Gas & Electric Corp.
Rochester 4, New York

What's Your Opinion

Readers are invited to send their opinions of all matters pertinent to the electric utility industry to the editor. An effort will be made to publish those of greatest interest.

About the finer points of metering:

Sangamo J2 Meters ...safety-packed in re-useable cartons

Sangamo J2 Watthour Meters are shipped to you in re-useable cartons that are scientifically engineered to maintain accurate factory calibration of the meters during shipment. J2 Meters, which are shipped sealed, arrive ready for use. They can be put on your lines, as received, without adjustment. Meters are fully protected against damage by the "floating method" of packaging. No part of any meter touches the sides, top or bottom of the outer carton.

Many power companies re-use these sturdy cartons, again and again, on their line trucks. Specify Sangamo J2 Meters—calibrated, sealed, and packaged for unimpaired accuracy.

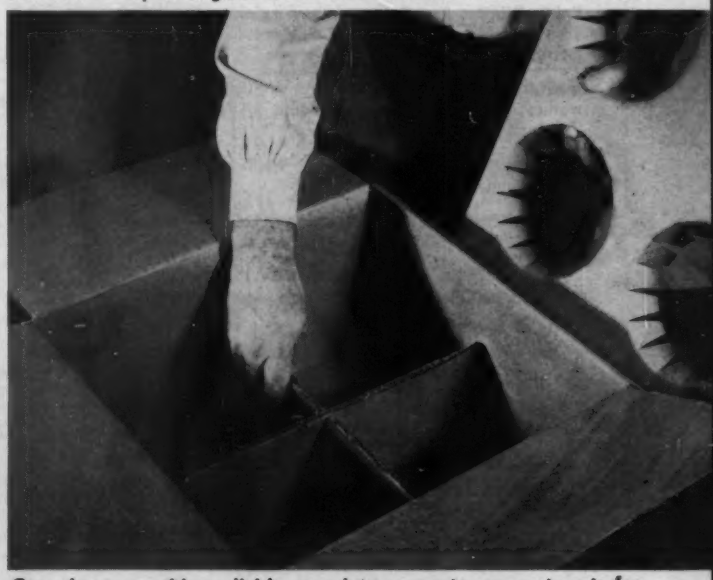
SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

JMS7-1

350 lb. test outer carton has double-protected top and bottom. Drop tests and shipping tests prove that the outer carton must be ruptured before meters can be damaged.

Specially designed die cut tray cradles meters in suspended position so that no part of glass covers touch the bottom or sides of case.



Cross brace partitions divide case into separate compartments for each meter and provide firm support for the die cut tray.

MEETINGS CALENDAR

APRIL

Southeastern Electric Exchange — 24th Annual Conference, Boca-Raton Hotel and Club, Boca Raton, Fla., April 1-3.

Edison Electric Institute—Sales Conference, Edgewater Beach Hotel, Chicago, April 1-4; Accounting Division Advisory and Executive Committee, Madison Suite, Sheraton Park Hotel, Wash., D. C., April 8; National Accounting Conference of Electric & Gas Utility Accountants, held jointly with AGA, Washington, D. C., April 8-10; Industrial Relations Committee, jointly with Personnel Sections of Indiana Electric Assn and Ohio Electric Utility Institute, and Personnel Practices Committee of Pennsylvania Electric Assn, Netherland Plaza Hotel, Cincinnati, Ohio, April 18-19; Meter and Service Committee, Sorena Hotel, St. Petersburg, Fla., April 24-26; Purchasing and Stores Committee Executive Committee and 10th Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Pa., April 28-May 1; Insurance Committee, Williamsburg Inn, Williamsburg, Va., April 29-30; Accident Prevention Committee, Algiers Hotel, Miami Beach, Fla., April 29-May 1.

National Industrial Conference Board—8th Atomic Energy Courses for Management, Rye, N. Y., April 1-6.

Indiana Electric Association—17th Annual Young Men's Utility Conference, Terre Haute House, Terre Haute, Ind., April 3-4.

American Institute of Electrical Engineers—Southern District Meeting, Heidelberg Hotel, Jackson, Miss., April 3-5; Great Lakes District Meeting, Hotel Fort Des Moines, Des Moines, Iowa, April 15-17; Third Biennial Conference on Electric Heating, sponsored jointly by AIEE and the Toledo section of AIEE, Commodore Perry Hotel, Toledo, Ohio, April 23-24.

Missouri Valley Electric Association—Engineering Conference, Hotel President & Municipal Auditorium, Kansas City, Mo., April 3-5.

Northwest Public Power Association — Annual Membership Meeting, Benjamin Franklin Hotel, Seattle, Wash., April 3-5; Engineering and Operations Section, Tacoma Utility Center and Winthrop Hotel, Tacoma, Wash., April 23-24.

American Society of Mechanical Engineers—Spring Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala., April 8-10.

Northeast Missouri Electric Power Cooperative—Eighth Annual REA Electric Generating Plant Operation and Maintenance Conference, Phillips Hotel, Kansas City, Mo., April 8-11.

National Electrical Industries Show—Fourth National Electrical Industries Show, 71st Regiment Armory, Park Ave. and 34th St., New York City, April 8-11.

Public Utilities Association of the Virginias—Rural Committee, Jackson's Mill, W. Va., April 9; Executive Committee, Richmond, Va., April 12.

Institute of Radio Engineers—First Annual Conference on Electronics in Industry, Illinois Institute of Technology, Chicago, Ill., April 9-10.

American Welding Society—Fifth Welding Show, Convention Hall, Philadelphia, Pa., April 9-11.

Electrical Engineers (ASEE) Exhibition, Ltd—Sixth Annual Electrical Engineers Exhibition, Earls Court, London, England, April 9-13.

Pennsylvania Electrical Association—Meter Committee, Garden City, Long Island, New York, April 11-12.

• **Tennessee Valley Public Power Association**—Annual Meeting, Read House, Chattanooga, Tenn., April 11-12.

Maryland Utilities Association—Annual Spring Business Conference, Lord Baltimore Hotel, April 12.

Agricultural and Mechanical College of Texas—Tenth Annual Conference for Protective Relay Engineers, A&M College of Texas, College Station, Tex., April 15-17.

Rocky Mountain Electrical League—Spring Conference, Shirley-Savoy Hotel, Denver, Colo., April 21-24.

Lead Industries Association—Annual Meeting sponsored jointly with the American Zinc Institute, Drake Hotel, Chicago, Ill., April 24-25.

National Industrial Research Conference — Sponsored by Armour Research Foundation of Illinois Institute of Technology, Conrad Hilton Hotel, Chicago, Ill., April 24-25.

• **Pacific Coast Electrical Association**—Administrative Services Section, Hotel La Playa, Carmel, Calif., April 24-25.

Association of Edison Illuminating Companies and Edison Electric Institute—Meter and Service Committee, Sorena Hotel, St. Petersburg, Fla., April 24-26.

Northwest Electric Light & Power Association—Engineering and Operating Section, Sun Valley, Idaho, April 24-26.

American Power Dispatchers Association, Inc—National Spring Meeting, Los Angeles, Calif., April 26-27.

Institute of Radio Engineers—Eleventh Annual Technical Conference on Television, Cincinnati Engineering Society Bldg., Cincinnati, Ohio, April 26-27.

MAY

• **American Institute of Electrical Engineers**—Northeastern District Meeting, Wendell-Sherwood Hotel, Pittsfield, Mass., May 1-3.

• **Edison Electric Institute**—Transmission and Distribution Committee, Muehlebach Hotel, Kansas City, Mo., May 2-3; Prime Movers Committee, Tides Hotel, St. Petersburg, Fla., May 6-8; Hydraulic Power Committee, Highland Hotel, Massena, New York, May 13-15; Industrial Relations Committee, EEI Headquarters, New York City, May 16; Electrical System and Equipment Committee, Statler Hotel, Buffalo, N. Y., May 20-21; Accounting Division Time and Place Committee jointly with AGA, AGA Headquarters, New York City, May 23; Financing and Investor Relations Committee, Edgewater Beach Hotel, Chicago, Ill., May 31-June 1.

Southeastern Electric Exchange — Engineering & Operations Sections, Fontainbleau Hotel, Miami Beach, May 2-3.

Air Conditioning and Refrigeration Institute—Annual Meeting, The Homestead, Hot Springs, Va., May 5-8.

• **Pennsylvania Electric Association**—Communications Committee, Hotel St. Francis, Canton, Ohio, May 6-7; Eighth Annual Customer Relations Conference, Hotel Hershey, Hershey, Pa., May 8; Electrical Equipment Committee, Hotel Roosevelt, Pittsburgh, Pa., May 9-10; Relay Committee, Bedford Springs Hotel, Bedford Springs, Pa., May 16-17; Systems Operation Committee, Skytop Lodge, Skytop, Pa., May 23-24.

Public Utilities Advertising Association—Annual Convention, Hotel Statler, Cleveland, Ohio, May 8-10.

• **Industrial Nuclear Technology Conference**—Museum of Science and Industry, Chicago, Ill., May 14-16.

Pacific Coast Electrical Association—Annual Convention, Fairmont Hotel, San Francisco, Calif., May 15-17.

• **American Institute of Mining, Metallurgical and Petroleum Engineers**—Eleventh Annual New England Regional Conference, Hotel Statler, Boston, Mass., May 17-18.

•. Additions this week.

Edison Electric Institute

Annual Convention will be held in the Palmer House, Chicago, Ill., on June 3-5.

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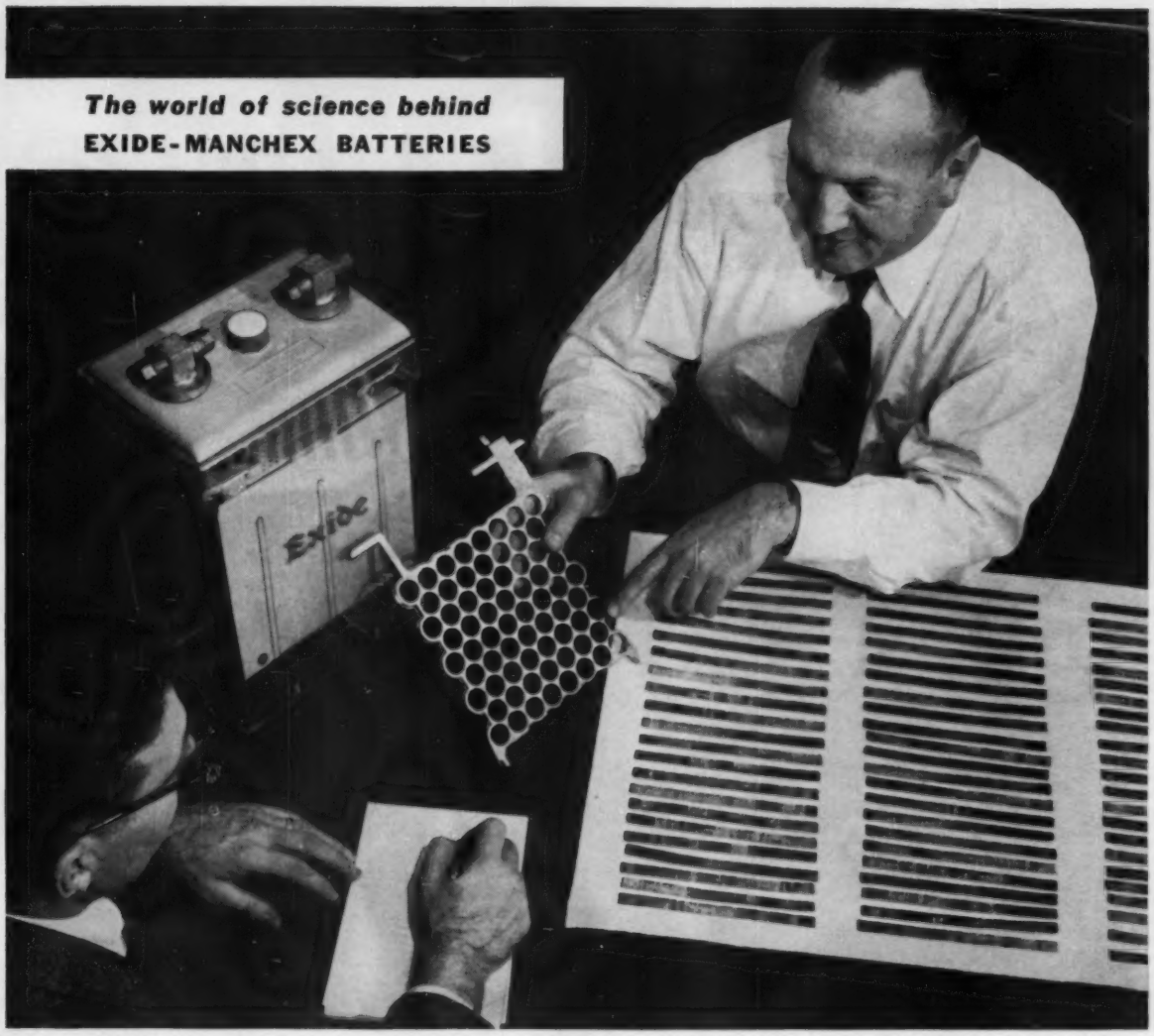

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Strauss: Yes, and also to give the electrolyte free access into the interior of the spiral buttons.

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Strauss: It means each part of the surface of the positive plate works easier to produce electricity. An Exide-Manchex can coast where many another battery is forced to strain. And the active material lasts years longer than it otherwise would.

Reporter: Is this construction available in any other battery?

Strauss: No, only in the Exide-Manchex.

Reporter: Obviously this is an important feature of the Exide-Manchex Batteries.

Strauss: Yes it is, but it's only one of many engineering details that contribute to their long life.

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